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NEWSLETTER

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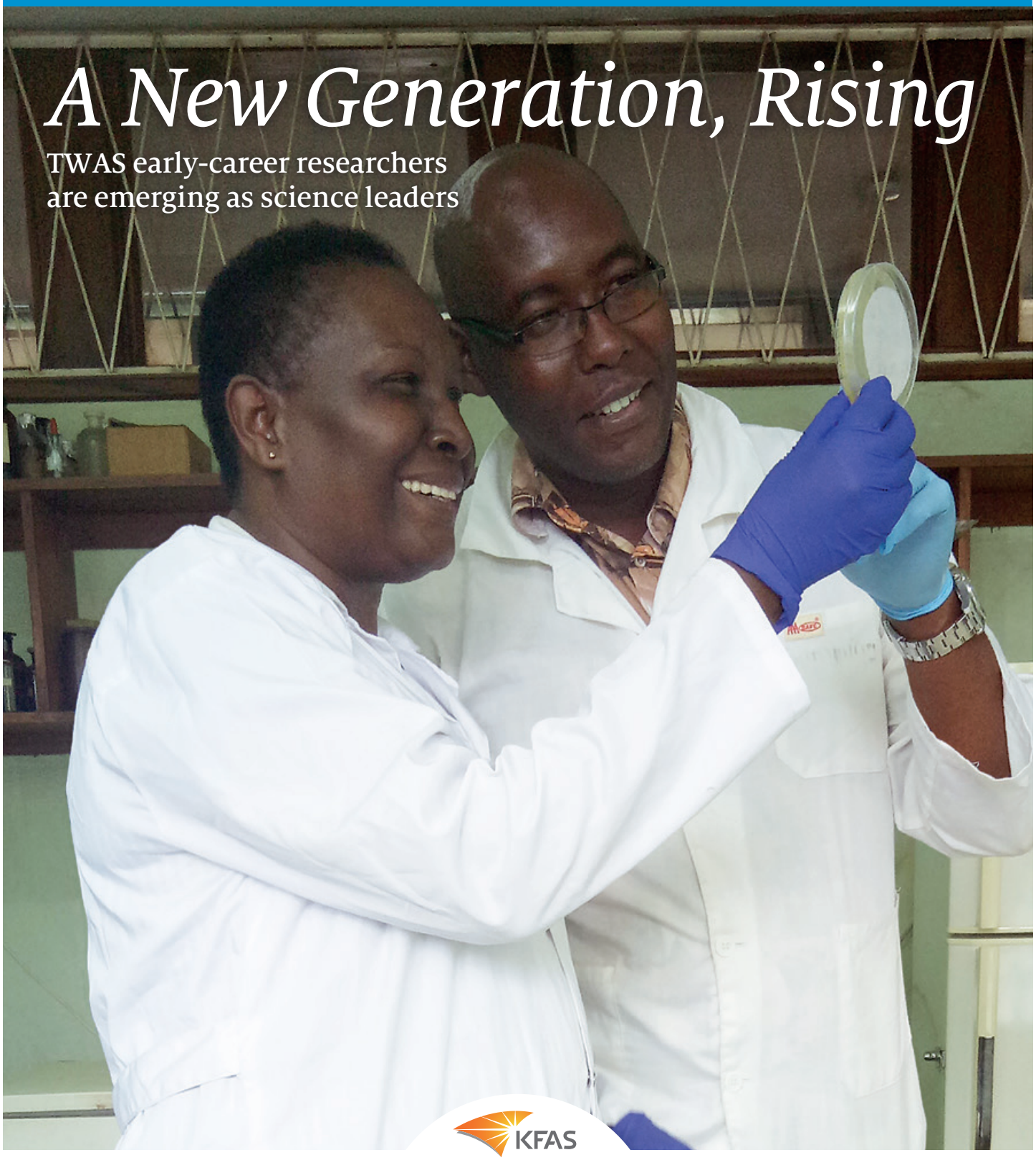
A New Generation, Rising

TWAS early-career researchers are emerging as science leaders



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▲ [top] Researchers affiliated with the TWAS Young Academy Network take samples to study soil biodiversity in Sri Lanka; [below] Attendees at the TWAS Research Grants conference in Tanzania discuss how to increase their scientific impact.

Cover picture: Kenyan microbiologist Atunga Nyachieo - the recipient of the first TWAS Young Affiliates Network grant - and his mentor Dr. Jesca Nakavuma at College of Veterinary Medicine, University of Makerere, Uganda.

▼ Finnish microbial ecologist Merja Itävaara, far right, at the Yangon University in Myanmar with officials from the Department of Research and Innovation in the Ministry of Education; ALARM Ecological Laboratory; and Yangon University. Itävaara was there as part of the Elsevier Foundation-TWAS Sustainability Visiting Expert Programme. [Photo provided]

EDITORIAL

TWAS YOUNG AFFILIATES: A PROMISING FUTURE FOR SCIENCE

▲ TWAS President Bai Chunli

To earn election to The World Academy of Sciences, researchers must achieve the highest impact in their fields, with excellence sustained over many years. It is understandable, then, that most of the scientists elected to the Academy are advanced in their careers: They have proven their skill beyond doubt, and they often are leaders of major institutions in science, government and business. They are justly considered role models, worthy of emulation.

But with the wisdom of years, we can see that there also is much to value in our younger colleagues: fresh creativity, bold ideas and the excitement of early accomplishments.

Recognising the importance of this energy, our Academy's leaders in 2007 created the Young Affiliates programme for accomplished researchers aged 40 and under. The programme has been at work for over a decade now, complemented by the creation in 2016 of the TWAS Young Affiliates Network (TYAN).

As this issue of the Newsletter demonstrates, these members of our community share a remarkable commitment to the TWAS mission: using science for healthy and prosperous communities, as envisioned in the United Nations' Sustainable Development Goals. At an early stage in their careers, our Young Affiliates are showing not only promise, but significant contributions to scientific knowledge.

TWAS turned 35 years old in 2018, and even in the Academy's earliest years, founder Abdus Salam spoke of the importance of scientific opportunities for young women and men from the developing world.

And yet this is a new generation, with access to technology, networks and travel that would have seemed almost impossible back then. Indeed, today's early-career scientists are making historic advances – but at the same time, they face old challenges.

In a 2014 report, "The Global State of Young Scientists", a team at the Global Young Academy found need for improvement in core areas: scientific training and mentorship; gender disparities; evaluation processes; and funding. They urged a scientific culture that provides fairness and creative research opportunities for early-career scientists.

This suggests that early-career scientists might be constrained from reaching their full potential. This would be a loss for all of us in the research enterprise, worldwide.

The TWAS Young Affiliates – working through TYAN – can provide an important voice in this global dialogue. The Affiliates represent 67 countries, including Bhutan, Costa Rica, Lesotho, Papua New Guinea and others where TWAS has no other representatives. In 2014, 19% were women, but that proportion has risen to 28%.

Our partners at Lenovo, the global computing leader, have provided generous funding to support the early years of TYAN. Already the members are staging events that have a direct bearing on science, policy and international cooperation.

We admire the Young Affiliates' commitment to excellence and impact, and we hope that many of them will continue their strong progress and in time be elected as TWAS Fellows. Just as important, we see them as future leaders in their institutions, their countries and in global science.

Clearly, their early work suggests great promise for the future.

Bai Chunli, *president, TWAS*

To learn more about the work of the TWAS Young Affiliates, read their profiles in the new TWAS Online Directory at www.twas.org/directory

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IN THE NEWS

Philippines enacts anti-brain drain law

The Philippines has enacted a law that provides assistance to Filipino scientists who intend to return to the country.

The new law institutionalizes a 40-year-old law that had previously helped 567 scientists return to the country to conduct their research, and expands their benefits and compensation.

Under the law, a returning Filipino scientist is entitled to a round trip airfare from a foreign country to the Philippines, relocation benefits for the scientist's family, as well as medical insurance and support in securing job opportunities and a working visa.

Asian Scientist:
www.bit.do/PhilippinesBrainDrain

Eastern Caribbean is swamped by seaweed

Barbados's Long Beach, typically a picturesque vision of white sand and blue water, is buried beneath a vast expanse of thick, rotting seaweed. It's a foul nuisance that has turned deadly.

Under normal conditions, floating sargassum seaweed is a thriving ecosystem and provides a vital habitat and food source in the open ocean for fish, turtles and crustaceans. But when it grows too thick, the seaweed washes ashore and clumps in dense, tangled mats so expansive and impenetrable that sea turtles and other surface-breathing animals can't break through.

Hakai Magazine:
www.bit.do/SeaweedSurge

Earthworm guts contain a key bacteria

Indian scientists have found that earthworms fill the role as a friend to farmers because their guts provide an ideal environment for nurturing a variety of cellulose-degrading bacteria. Earthworms are in effect acting as engineers in soils. They are helpful in the decomposition of waste, producing biofertilisers. Researchers found the distinct composition of cellulose-degrading bacteria specific in two major species of earthworm.

India Water Portal:
www.bit.do/WasteAndWorms

Can insurance protect coral reefs?

Coral reefs, mangroves and even some fish could soon have their own insurance policies as the insurance industry seeks new ways to boost protection for reefs affected by ocean changes wrought by the climate crisis.

Insurance industry experts speaking at the Ocean Risk Summit in reinsurance hub Bermuda said so-called "ocean risk" – which encompasses storms and hurricanes as well as marine diseases and declines in fish stocks – can present opportunities for insurers if the risks are modelled correctly.

Thomson Reuters Foundation:
www.bit.do/InsuranceProtection

Vitamin D3 boost helps treat child malnutrition

High doses of vitamin D3 can help treat severe child malnutrition, suggesting health officials should revise standard treatments.

A clinical trial in Pakistan's Punjab province found that vitamin D3 supplements added to treatment for malnutrition led to significant improvements in a group of 185 children aged 2-58 months. The eight-week treatment led to weight gain and improved motor skills and learning abilities.

SciDev.Net:
www.bit.do/VitaminD3

TWAS YOUNG AFFILIATES

INNOVATION: THE NEXT WAVE

Moses Laman, a TWAS Young Affiliate from Paupa New Guinea, evaluates a malaria patient. [Photo provided]

Blend excellent skills, fresh ideas and a commitment to problem-solving and you get a portrait of the TWAS Young Affiliates. They are poised to be next-generation science leaders.

by **Cristina Serra**

From Mexico to Brazil, from Ethiopia to Oman and across to Uzbekistan, Thailand and Vietnam, and in more than 60 other countries worldwide, TWAS is engaging a new generation of highly skilled and highly promising researchers in its Young Affiliates programme.

The Young Affiliates were launched in 2007 to bring promising early-career scientists into the orbit of TWAS Fellows, creating opportunities for learning and collaboration, and also to bring new perspectives into the Academy's affairs. Today, the current and alumni Affiliates number almost 300 scholars – nearly 30% of them women. And they are now an influential voice in the global scientific scene: engineers, doctors, chemists, food experts and climate scientists, astronomers and geneticists eager to make their mark on science.

Up to five talented researchers from developing countries, aged 40 and under, are selected each year by TWAS's five Regional Partners on the basis of their publications and their scientific impact. After a five-year appointment, each Young Affiliate becomes a TWAS Young Alumnus.

But several years ago, alumnus Yin Li of China advanced an idea: Why not create an organisation of Young Affiliates to serve as a platform for their energy and ideas?

TWAS and the Chinese Academy of Sciences welcomed the initiative. As a result, the TWAS Young Affiliates Network – TYAN – was founded in 2016, supported by a significant three-year grant from Lenovo, the global leader in computing and technology. TWAS President Bai Chunli praised the new organisation, calling it "a platform where young scientists can make contributions to the excellence of science, and also encourage collaboration in developing countries."

"TYAN allows people from the remotest places of the world to do good science and develop useful technologies in spite of all the difficulties," says TYAN co-Chair Patricia Zancan, a cancer researcher at the Federal University of Rio de Janeiro in Brazil. "TYAN brings us closer together and makes us understand the regional differences, the challenges we face and the ways these challenges may be overcome."

TYAN is focused on communication, new partnerships and collaborations, and sharing knowledge for problem-solving. That includes the role of providing TWAS with input on the most urgent needs of young scientists in developing countries.

"I am thrilled to be part of such an exciting group," says TYAN member Emile Chimusa, a mathematician from the Democratic Republic of Congo. "Complexity in our world calls for creating strong and competitive networks like this one, where we can share and cross-validate data and ideas."

The members are diverse, but in their ambitions and optimism, they share a common vision.

MOSES LAMAN: PAPUA NEW GUINEA

In the Pacific island nation of Papua New Guinea (PNG), more than 5% of children die before they are 5 years old. But a range of paediatric diseases would be preventable if stricter sanitary measures were in place and health systems were strengthened.

This is where Moses Laman, the head of the vector-borne diseases unit at PNG Institute of Medical Research, is fighting a daily battle. Laman, a clinician scientist,

general paediatrician and a 2014 TWAS Young Affiliate, has been leading studies on malaria, bacterial meningitis, pneumonia, malnutrition, viral encephalopathy and other childhood and maternal illnesses since 2003.

"Seeing so many children dying of preventable diseases is hard to bear," Laman said in a recent interview. "I had to contribute in another way – through research, because many losses are preventable through better knowledge and health care."

Laman's clinical studies have addressed, in particular, paediatric malaria, which in its severe form – cerebral malaria – is often complicated by anemia and coma, eventually leading to death if the patient comes late to hospital or the treatment is delayed. Laman's work in PNG contributed to the global knowledge that *Plasmodium vivax*, and not just *Plasmodium falciparum*, which is widespread in Africa and the rest of the world can also cause severe malaria.

> "Seeing so many children dying of preventable diseases is hard to bear... because many losses are preventable through research."
>
> *Moses Laman, 2014 TWAS Young Affiliate*

"We found specific features that are unique to children in the Oceania region," he explained. He and his team proved that, in PNG, malaria rarely manifests along with bacterial infections, a form of co-infection that is much more common in Africa, rates of hypoglycaemia are lower, mortality from severe malaria is lower, and simple diagnostic tools such as the malaria Rapid Diagnostic Test can assist clinicians to predict prognosis in severely ill children. "These observations helped us to establish clinical guidelines in our settings to obtain more efficient patient management."

As part of a study investigating febrile convulsions in PNG children with severe childhood infections, Laman also developed a clinical algorithm to assist clinicians decide which children are likely to have meningitis and differentiate them from those with severe malaria who may not need a lumbar puncture. This findings have become part of the country's Standard Treatment Guidelines for paediatrics.

Laman also addressed bacterial resistance to antibiotics, caused by misuse or overuse of such drugs. His research provided evidence that have guided policy and practice in his country, as well as in other developing countries, where antibiotics like chloramphenicol have now been replaced by ceftriaxione for the treatment of meningitis.

▲ Moses Laman of Papua New Guinea in the paediatric ward with young patients.

WARSHI DANDENIYA: SRI LANKA

How many micro-organisms are there in a teaspoon of soil? More than the number of humans on Earth. Many of them are still not classified but they are all, or almost all, essential for circulation of nutrients in the food-chain, and to preserve the quality of environment for other organisms – including humans.

Warshi Dandeniya, the head of the department of soil science at the University of Peradeniya in Sri Lanka, explores the diversity of micro-organisms living in soil environment to enhance food security and quality.

"Sri Lanka hosts many bacterial and fungal species that previous research has never described," she notes. "They could be effectively used to improve foods as a source of nutrients. And they could also be used to prepare

> I'm proud to be part of this exciting platform of international scientists. We are young and enthusiastic, and we can be an active force for a global change.
>
> *Warshi Dandeniya, 2017 TWAS Young Affiliate*

biofertilizers, providing plants with the right amounts of nitrogen and phosphorous without using synthetic fertilizers."

Dandeniya, elected a Young Affiliate in 2017, is worried by the high costs and the impact of synthetic fertilizers in Sri Lanka. "Almost 90% of fertilizers used in my country are imported, and have a high impact on the environment," she said. "I feel it is mandatory to address this issue, trying to reduce their use, and in this way to help the economy."

In a project she is supervising, Dandeniya aims at formulating a nitrification inhibitor using plant-based substances to suppress the rate of chemical transformation of ammonium to nitrate in the soil. This is helpful to reduce wastage of fertiliser-nitrogen applied to soil and enhance nitrogen availability for plant uptake. In another project, she is developing a biofertiliser with phosphate-solubilizing bacteria to use in rice cultivation, which could reduce the need for synthetic fertilisers.

◀ Research by Warshi Dandeniya of Sri Lanka tries to understand the negative impact of over-use of antibiotics in farm animals.

▲ From top: 2014 TWAS Young Affiliate Moses Laman from Papua New Guinea, and 2017 TWAS Young Affiliate Warshi Dandeniya from Sri Lanka.

Another matter of concern she is working on is the widespread use of antibiotics in farmed animals and its effect on the environment. "Each time farmers toss away the bedding materials, through the manure they spread into the environment the residues of antibiotics animals have received and the antibiotic resistant gut flora," she maintained. "This worsens the issue of antibiotic resistance development and its spread," because when bacteria come into contact with these substances and antibiotic resistance gene pool they can, in the long run, develop resistance to the drugs.

Dandeniya will be a Young Affiliate and a member of TYAN until 2021. "I'm proud to be part of this exciting platform of international scientists," she says. "We are young and enthusiastic, and we can be an active force for a global change."

EMILE CHIMUSA: DEMOCRATIC REPUBLIC OF CONGO

All people are born similar, but each person is endowed with a unique genetic profile that shapes his or her life. And this helps to explain why humans experience so many differences when it comes to disease: some have natural resistance to Ebola virus, while others die. Some can be cured by a certain drug, others cannot.

This is where mathematics and statistics can help medicine. Using statistical tools to analyse large genomics datasets, map complex

> Early in my career... I decided that I would use maths to answer medical questions like: Why are some people allergic and others are not?
>
> *Emil Chimusa, 2017 TWAS Young Affiliate*

diseases and investigate population genetic structure is a way to understand individual differences – and to chose better treatments. This is the field where Emile Chimusa, a scientist from Democratic Republic of Congo, is applying his skills.

"Early in my career," he said recently, "I started seeing human diversity under a mathematical perspective, and I decided that I would use maths to answer medical questions like: Why are some people allergic and others are not?"

Chimusa is a 2017 TWAS Young Affiliate who served as a software developer and database designer at the independent electoral commission for the United Nations mission in the Democratic Republic of Congo.

Today, he is leading the research platform "Computational and statistical methodologies for human and environmental health prediction", at the Council for Scientific and Industrial Research Centre for High Performance Computing in Cape Town, South Africa. There, he carries out genomics studies with potential clinical applications.

"When we decipher the DNA code of our samples, we understand if a specific DNA mutation has a protective effect, or if it increases the disease risk," he explained. "This is the way to personalized medicine."

RYM KEFI-BEN ATIG: TUNISIA

Tunisia is located at the crossroads of Europe, the Middle East and Sub-Saharan Africa. This position has led to migration waves since the prehistoric period, contributing to the current genetic landscape of the population. Today Tunisia is challenged by the increase of non communicable multifactorial diseases and exhibits a high degree of genetic disorders, due to the historic incidence of marriages between closely related individuals.

▲ From top: 2017 TWAS Young Affiliate Emile Chimusa, and Rym Kefi-Ben Atig, a 2010 TWAS Young Affiliate, now a TWAS Alumnus

> My work is a huge challenge due to limited funding and infrastructure. Being a TYAN member, I can expand my scientific network.
>
> *Rym Kefi-Ben Atig, 2010 Young Affiliate Alumna*

Rym Kefi-Ben Atig, is a senior lecturer at Institut Pasteur in Tunis (IPT), team leader in the laboratory of biomedical genomics and oncogenetics and responsible of the genetic typing laboratory at IPT. She was a 2010 TWAS Young Affiliate, and is currently a TWAS Alumnus. She is mainly involved in research on human genetic disorders and genetic diversity in North Africa.

"I feel I have the responsibility to help my country, avoiding the occurrence of these genetic diseases, by applying my knowledge and experience," she explains. And she adds: "My work is a huge challenge due to limited funding and infrastructure: that's why I'm glad to be a TYAN member, as I can expand my scientific network and set up productive collaborations."

▼ From left: Emile Chimusa working in his laboratory, and TWAS Young Affiliate alumna Rym Kefi Ben Atig receives Tunisia's Arvea Women Award in 2018. (Photo provided)

▲ Rolando Gittens in his lab, carrying out experiments. His work is focused on bone and brain regeneration.

Kefi-Ben Atig has shown that the genetic background of the Tunisian population reflects genetic contributions of various origins: North African, Euro-Asian and Sub-Saharan African. Her research has allowed molecular characterization of genetic diseases such as the metabolic disorder called glycogenosis, affecting glycogen storage, the genetic disorder called Gaucher disease and deafness. Her intervention has permitted early and preventive action.

Another field of investigation focuses on Type 2 Diabetes (T2D) and metabolic syndrome, integrating epidemiological, genetic, and nutritional information. "I am working on the identification of new biomarkers that will allow better understanding of the origin of T2D, to improve the health care of patients and to prevent degenerative complications," she explained.

Rym Kefi is also an expert in DNA profiling, which allows identification of victims based on tiny organic samples of body tissue or fluid. "Mastering these tools is a resource," she says. "And if I can use it to my nation's benefit, I am honoured."

▼ Rolando Gittens is a 2017 Young Affiliate from Panama.

ROLANDO GITTENS: PANAMA

Panama has enjoyed strong economic growth in recent years. This progress has an important consequence: Panama's population is living longer, but older people start suffering from diseases and disorders related to advanced age. This has an impact on the quality of life.

> "Being a member of TYAN... is an injection of energy that stimulates me to create an international network of experts."
>
> *Rolando Gittens, 2017 TWAS Young Affiliate*

Rolando Gittens, a research engineer at the Institute for Scientific Research and High Technology Services in Panama City, was elected a TWAS Young Affiliate in 2017. He is applying his problem-solving skills to the regeneration of injured brain and bone tissue.

"Millions of people today experience cerebral ischemia, the lack of blood flow/oxygen that damages the brain," he explained. "Once the brain is injured, there is little we can do to retrieve the lost function... What we explore is the use of stem cells, immature cells that can be chemically encouraged to differentiate, to promote regeneration of the brain's damaged areas."

In another field, Gittens is studying how to make better bone implants. "People receive bone implants at early ages with respect to the past, hence implants need to last longer," he observed. "Therefore we get inspiration from nature."

Gittens and colleagues are exploring bone scaffolds with particular shape at the macroscopic level, and different texture/roughness at micro- and nano-scale, which should encourage the proliferation and differentiation of bone-building cells and guide them to the point where they're needed.

"Being a member of TYAN is not only a great honour," he said. "It's also an injection of energy that stimulates me to create an international network of experts in these fields." To this purpose, Gittens co-organises a small scientific event in Panama, called 'Bioinformatics, Biosciences and Bioengineering (B3) Symposium' for scientists in the Latin America and Caribbean region. ◘

Q&A THE CHALLENGES FACING YOUNG SCIENTISTS

Three young scientists reflect on the barriers holding back early-stage research careers in the developing world – and some possible solutions.

To support a future of global prosperity, there will need to be scientists in every corner of the globe. This is especially true in developing countries, which need a strong corps of young scientists to conduct today's innovative studies and also mentor the next generation of researchers who will carry on that work.

That is the case laid out by three developing world scientists, biotechnologist Yin Li of China, economist Fatima Kareem of Nigeria, and botanist Nudrat Aisha Akram of Pakistan. Barriers to the success of young scientists from the Global South amount to barriers to their home countries' advancement, and these nations and the world both must invest in more financial support and better mentorship for these researchers if they hope to thrive.

In the following Q&A, TWAS staff writer Sean Treacy conducted an email interview with Li, Kareem and Akram to assess the most important challenges they confront, as well as the best solutions available today and pursuable in the future.

What are the most common obstacles facing young scientists across the globe? Which are the most important for the scientific community to address?

Li: Young scientists across the globe face obstacles in understanding the essence of science and why we are doing research. They also face challenges related to maintaining a good balance between their research careers, societal recognition and family obligations. The most important tasks for the scientific community to address include appealing to all the governments to increase investment in science, technology, innovation and capacity building, as well as to increase the societal awareness of the importance of science.

Kareem: The major challenges facing young scientists are limited accessibility to research and infrastructural funds, lack of mentors or role models that can guide them in the scientific process, and poor mentoring. Other common obstacles include limited scientific networks and research mobility at the early stage of their careers, poor work-family balance, poor work-life balance, gender inequality in science, and gender discrimination which perpetuates the

> "The major obstacle for young scientists in the developing world is the lack of good infrastructure for research and funding opportunities."
>
> *Yin Li, co-chair of TWAS Young Affiliates network*

> Young scientists with families face distinct problems because they are under significant pressure from combining childcare duties with their careers, which might impact the pace at which their careers progress.

Fatima Kareem, project researcher at the Global Young Academy

existing gender inequality. All obstacles should be addressed, but more importantly, the scientific community should prioritise the issue of poor mentorship, limited access to funds and gender inequality. For instance, proper mentorship can relieve the impacts of the other obstacles faced by young scientists.

Akram: There is a number of obstacles faced by young scientists all over the world. Of them the most common and important are: 1) funding opportunities for doing novel research or even confirmation of prominent findings, 2) infrastructure and facilities in the relevant scientific laboratories, 3) assignments that are unproductive and take up time – such as arrangements for tours, annual dinners, fundraising, irrelevant compulsion to attend meetings – at the initial career of a researcher, and 4) job opportunities and sustainability.

Are there any distinct differences between the obstacles faced by young scientists in the developed and developing world?

Kareem: Young scientists in developing countries have higher barriers to access research infrastructure and funding than those from the developed countries, because developing countries place less priority on R&D. While funding is a cross-cutting problem, however, the problem is aggravated for scientists in developing countries as they often lack grant-writing skills and have no training in fundraising. Another distinction is that young scientists in developing countries are less mobile than those in developed countries due to inadequate opportunities, not being competitive enough and visa problems. In addition, their ability to publish in high-impact peer-reviewed journals is a huge problem. Many of these problems are faced by scientists from developed countries, but to a lesser extent.

Akram: As I interact with a number of young researchers from developed and developing countries, I learned that in the developed countries scholars face less funding issues than scholars in developing countries. For example, in developed countries, all young scientists have opportunities equal to those of senior/experienced scientists as well as promotions are entirely performance-based. While, in the developing countries, there are more funding opportunities for senior/experienced scientists as compared to that of young scientists. In addition, in the developing countries, promotions are based entirely on job experience as well as age of the young scholar.

Li: The major obstacle for young scientists in the developing world is the lack of good infrastructure for research and funding opportunities. While in developed countries, the main obstacles would be how to create novel ideas, and how to get societal recognition.

Many developing countries have much less funding and resources available than developed countries. What can they do to address the lack of resources and funding for young scientists at home? Are there any successful examples that stand out?

Akram: In this context, the developing countries must have elaborate funding agencies at the national level. They can start outreach, as well as small industrial programs. They can do many MoUs at national and international levels. Moreover, in such countries, there must be some funding organizations that entirely support young scientists. Similarly, in addition to the senior scientists and researchers, at least one of the young scientists must be included in the fund-approval committee.

Li: The essence of science is to better understand nature and to create a better life for human beings. If young scientists working in developing countries can target urgent societal needs, it is likely that they can get support. One successful example is Dr. Atunga Nyachieo, a TWAS Young

Affiliate from Kenya. Through a very small grant from the TWAS Young Affiliates Network (TYAN), he was able to master techniques for using bacteriophages to overcome antibiotic resistance that poses a severe threat to public health. This showcases that selecting a right direction for one's research is vital for getting resources and funding.

Kareem: UNESCO, through the Incheon Declaration, recommended that all national governments should allocate between 4-6% of their GDP to education and/or allocate a minimum of 15-20% of their total public expenditure to fund education and achieve the SDG goal 4, quality education. However, in many developing countries, budgetary allocation to research and development is less than 1% of GDP and government's expenditure on education is below the percentage recommended to achieve the goal. Thus, one important way to address the inadequacy of resources and funding for young scientists is for the governments of developing countries to increase budgetary allocation to education, particularly for tertiary education.

How can research organizations adapt to better accommodate young scientists with families?

Li: If the family member is also a scientist, try to find a full- or part-time job for the family member so as to maximize the value of manpower. If not, help identifying appropriate opportunities for them would also inspire the young scientists and their families.

Kareem: Young scientists with families face distinct problems because they are under significant pressure from combining childcare duties with their careers, which might impact the pace at which their careers progress. Affirmative policies that ensure family-work compatibility in the workplace is one way of accommodating them to reduce or eliminate any negative effect parenthood has on their career. The effort is not limited to research organisations. Other institutions and stakeholders must also accommodate them through flexible work arrangements, providing on-site childcare, and individual assessment when determining tenure. In addition, donors should accommodate them by taking individual situations into account during grant reviews. Selected international funders recognise individual situations but these are rarely taken into factors by local funders.

Akram: I think organizations should properly accommodate young scientists first – this is more important than accommodating their families. However, if families can be accommodated as well, it will produce good outcomes.

Do the barriers vary according to gender? What challenges do women in particular face?

Kareem: Barriers vary by gender and are more particularly significant for the women than men. Women assume many responsibilities, such as unpaid domestic work and reproductive duties, such as child-bearing and child-care. Combining huge unpaid responsibilities with their careers can result in significant time constraints

> "In a real sense, young researchers are very interested to cooperate with industries, which prefer young scientists to experienced scientists."
>
> *Nudrat Aisha Akram, 2015 TWAS Young Affiliate*

PROFILES

Yin Li is the director of the CAS-TWAS Centre of Excellence for Biotechnology in Beijing, China, an adjunct professor at the University of Science and Technology of China and chair of TYAN, the TWAS Young Affiliates Network. His research specialisations include microbial physiology, microbial genomics, metabolic engineering, fermentation engineering and systems biotechnology.

Fatima Kareem is a Nigerian and has a Ph.D. in economics from the University of Göttingen, Germany. As an economist, she researches development issues. She works as a project researcher at the Global Young Academy, in Germany, on a project investigating the state of young scientists and scholars in Africa.

Nudrat Aisha Akram is a TWAS Young Affiliate and member of TYAN, currently working as an assistant professor of botany at Government College University in Lahore, Pakistan. She is also a member of the Pakistan Academy of Sciences (PAS), and a PAS Gold Medal recipient. Her research focuses largely on improving the ability of crops to endure environmental stress.

and career interruptions which affect their scientific progression relative to men. This significantly disadvantages women, making them less scientifically mobile, especially if their children are young. Career breaks can make them to have fewer scientific publications, which might in turn impact on their ability to secure competitive funds. Besides, women also experience more gender-based discrimination. They are more likely to be stereotyped as being unfit for scientific roles and less likely to hold managerial positions.

Akram: Yes, barriers vary drastically, particularly in developing countries. In developing countries, education discrimination exists starting from childhood. In developing countries, female education is usually discouraged. During job opportunities, men are usually preferred over women. Furthermore, women have some common issues in both developed and developing countries including pregnancy, leaves, babies to look after during working hours, cooking and home responsibilities. In addition, opportunities for women to travel is not encouraged all over the world.

Li: At the PhD student level, women scientists are doing as excellent as men scientists. The fact that there are fewer women scientists working as principal investigators is largely due to their family burdens and societal roles. In some countries, the situation is better as women scientists get more societal support. So I think societal and organizational support is vital to get more outstanding women scientists to work in the frontier of science.

What kind of research still needs to be done to ensure that young scientists in the most low-resource areas can have their needs addressed? Who could conduct this research?

Akram: At the national level, every country should revisit their policies. I think free facilities for analysis must be ensured at institutional levels for young researchers within a country. Furthermore, research linked to commerce and industry must be encouraged. In real sense, young researchers are very interested to cooperate with industries, which prefer young scientists to experienced scientists.

Li: Across the globe, what young scientists need is the commitment from their government and society that their country will constantly invest in science. However, presently it is not clear what the percentage of well-educated people (at least at the college level) is in most low-resource areas, how many of these college-level people are interested in becoming "scientists", and what science means to the young generation in those areas. The governmental and societal recognition of the importance of science is crucial for inspiring young people to become scientists. In this regard, I think UNESCO is the suitable international organization to lead such a research.

Kareem: Research into the welfare and career development of young scientists is important to widen understanding of what dictates young scientists' career trajectories, opportunities, and challenges, to highlight recommendations that will help them overcome these challenges. This research should be conducted by governments, think thanks, research institutions, individuals and others. Such research is currently done by the Global Young Academy (GYA) through the Global State of Young Scientists (GloSYS). The GYA has completed a precursory global study, a GloSYS ASEAN (Association of Southeast Asian Nations) study, and has almost completed a GloSYS Africa study. The results have generated media discussion and led to important policy initiatives, including the ASEAN Science Leadership Programme initiated in 2018. ◘

A SMALL GRANT CAN CHANGE THE WORLD

Kenyan medical researcher Atunga Nyachieo is using a grant from the TWAS Young Affiliates Network to explore a novel attack on drug-resistant microbes.

by **Cristina Serra**

Bacteriophages, or phages, are small bacterial parasites that help microbes to cope with environmental dangers. To return the favour, bacteria offer phages a shelter from the outer world. This is why they have evolved together across millennia.

But when it's time to reproduce their DNA, some phages hijack the bacterial machinery and punch a hole in the host cell wall to escape. Now, using an innovative new grant from the TWAS Young Affiliates Network (TYAN), Kenyan researcher Atunga Nyachieo is exploring ways to use this natural behaviour to kill dangerous antibiotic-resistant bacteria from within – and without drugs.

"Phages live in bacteria and do not affect humans and animals, therefore we may think of them as of useful tools," explained Nyachieo, the chief of research at the Institute of Primate Research, a World Health Organization (WHO) collaborating centre based in Nairobi.

As a 2014 Young Affiliate, Nyachieo belongs to a growing international group of early-career scientists that the Academy has been selecting since 2007 for their early success and future potential. He is also a member of TYAN. The network launched in 2016 during the Academy's 27th General Meeting in Kigali, Rwanda, with the generous financial support of Lenovo, the global computing and technology leader.

Nyachieo earned his PhD in biomedical sciences from the Catholic University of Leuven, Belgium, and developed strong skills in reproductive biology and in child mortality linked to diarrhoeal diseases. But he recently broadened his scientific interest to phages and bacterial resistance to antibiotics. To address a threatening global health problem, he decided to explore the feasibility of using phages to kill resistant microbes.

Thanks to the TYAN Collaborative Grant Award, Nyachieo spent 15 days in a laboratory at the University of Makerere, Uganda, learning new techniques on phage cultivation and manipulation. The lab is led by a respected microbiologist, Jesca Nakavuma, and is based at the College of Veterinary Medicine.

The TYAN grants, available only to TYAN members, are worth USD3,000. But they're

short-term, covering only a 15-day collaboration. That means he had to work fast to build new skills and make progress on his research.

Does two weeks seem too short to get results? Indeed it is not. "With only 15 days to complete a project, grant winners remain focused on their task and are result-oriented," explained Sok Ching Cheong, a TYAN co-chair and a group leader at Cancer Research Malaysia in Selangor, Malaysia.

The grants were established early in 2018 and are awarded on the basis of scientific merit. They're directly aligned with TYAN's mission: offering the chance to move, visit foreign labs and learn new skills – and, in the process, stimulating global collaboration among young scientists. Nyachieo got his grant in April 2018.

What provoked his interest in bacterial phages are the alarming global estimates on antibiotic resistance. According to the survey "Review on Antimicrobial Resistance" authored by British economist Jim O'Neill, by 2050 as many as 10 million people worldwide could die from harmful, drug-resistant microbes. Of these, 80% could be in developing countries.

▲ Atunga Nyachieo, 2014 TWAS Young Affiliate

▼ Atunga Nyachieo and colleagues during lab work with bacteriophages, in Uganda.

"With these figures in mind, I decided that I should try to help find a solution to this problem, using bacterial phages as a boomerang to kill resistant bacteria from inside," he explained in a recent interview. "In Uganda I learned phage-specific assays and studied the main properties of phages that are specific for bacteria like *E. coli* and *Salmonella*, two strains that pose a big challenge due to their ability to resist to common antibiotics."

In Uganda Nyachieo also met some of Nakavuma's partners, who are now part of his wide international network: Elizabeth Kutter of Evergreen State College (USA); Martha Clokie from the University of Leicester (U.K.); and Tobi Nagel, the president and founder of U.S.-based Phages for Global Health. In addition, he expects to publish a paper soon on the work he did in Uganda.

> "Working full-immersion with no administrative or social distractions helped me to make important progress, useful to my career."
>
> *Atunga Nyachieo*

Upon returning to his home lab in Kenya, he started the purification and genetic characterization of his potential therapeutic phages, an important step before he begins to use them for human therapy.

"This exciting experience has left me with many gifts," Nyachieo said. "Working full-immersion with no administrative or social distractions helped me to make important progress, useful to my career. On the human side, short as it was, the integration with Ugandan people and culture has enriched me." ◘

Learn more: www.twas.org/node/14630/

STRONG FOUNDATIONS FOR A LIFE IN RESEARCH

Strategies to increase competitiveness, shape scientific skills and improve research outcomes were a focus for 27 TWAS Research Grants awardees in Tanzania.

by **Cristina Serra**

Passion and commitment are not always enough, at least in science, where pitfalls are always around the corner. Sometimes scientists may become obsessed with publications, and then may be seduced by plagiarism or lured to predatory journals. At times, they might lack success just because their grant proposals are poorly written.

In a powerful TWAS conference held in Dar es Salaam, Tanzania, from 28-31 August 2018, 27 African scientists received counsel on how to improve their research, build international collaborations and link research to industry. And they learned how to have more impact in their field.

"Scientists should not do research just for the sake of doing it," observed Esther Mwaikambo, the president of Tanzania Academy of Sciences in her opening speech at the 2018 TWAS Research Grants conference, "Building Skills for Science in Africa". Rather than getting good results, publishing them and then stopping, she added, it is much more important to do something that will make a change in people's lives.

Mwaikambo, a senior paediatrician at the Hubert Kairuki Memorial University in Dar es Salaam, is a role model for women in her country, and during the conference offered encouraging words for women scientists. "In Tanzania, there is no such issue as the gender balance," she said. "The problem is another one: women do not choose a scientific career."

But, she added: "If women scientists keep their spirits and confidence high, they can achieve anything."

The Research Grants Conference was organized by TWAS and sponsored by the Swedish International Development Cooperation Agency (Sida), with local support from the Tanzania Academy of Sciences. It hosted 27 past TWAS research grant winners from 17 African countries, with the aim of offering examples of good science and return on investment.

The TWAS Research Grants programme is one of the earliest and most successful of the Academy's programmes. It was established in 1986 to meet the needs of promising young scientists from developing countries who needed equipment, consumables and access to scientific literature, said TWAS Programmes Coordinator Max Paoli.

Through the decades, the programme has expanded and today TWAS annually awards more than USD1 million in grants to individual scientists and groups.

Winning a TWAS Research Grant is a privilege, but it is just a beginning, observed Burkinabè entomologist Awa Gneme, a 2015 TWAS Research Grant recipient who traps mosquitoes and studies their DNA in hopes of advancing progress against malaria.

Gneme has wanted to study malaria since her school days because it is a serious problem in Burkina Faso, accounting for 61.5% of hospitalisations and 30.5% of deaths each year. She realised that many mosquitoes carry bacteria, parasites and viruses that could be bite-transferred to humans, causing debilitating diseases other than malaria. She also realised

▼ From top: Entomologist Awa Gneme from Burkina Faso; and Amadou Dicko, an agronomist from Mali

that changes in land use, such as deforestation, have an impact on the mosquito's abundance and community composition.

"This is why it is very important to understand what environmental variables drive their living choices, and to instruct people on the best way to avoid their presence," Gneme explained. Her two-year project, funded by a TWAS grant, involves the study of the mosquito genetics and allows close contact with local communities, where she teaches strategies to protect from the insects' bites.

From Tanzania, Gneme took home some tangible new resources for her research. During a networking exercise aimed at connecting scientists who live across Africa, seven colleagues – from Angola, Sudan, Togo, Kenya, Burkina Faso and the Republic of the Congo – asked to start collaborations with her.

INVESTING IN SUSTAINABLE DEVELOPMENT

The Dar es Salaam conference also featured Revel Iyer, director of the technology transfer office at Cape Peninsula University of Technology (CPUT) in Cape Town (South Africa). Iyer, an expert in Africa's patent system, a scientist and inventor offered insight on the importance of patenting and protecting research findings.

Developing discoveries into useful products and patenting the resulting innovations is an important way to ensure that research in the lab translates into practical benefits, he said. "Filing patents should be done to protect potentially lucrative inventions that may provide a large financial return," Iyer counseled. "Patenting for the sake of patenting is not advised."

But the patent culture has not taken roots, yet. That's why institutions should press proactively for a cultural shift highlighting that the research occurring in the lab is relevant to society.

One TWAS grant has been useful in supporting high-impact research in Mali. There, agronomist Amadou Dicko is isolating useful microbes that promote plants' growth or activate their defences.

"Some soil bacteria act as sentries," Dicko explained. "Upon perceiving the danger posed by ill-causing bacteria or pathogens, they produce hormones that sound as an alarm. This triggers a quick response: plants react by releasing smelly chemicals that kill dangerous microbes or keep them at a distance."

▲ From top: Esther Mwaikambo, president of Tanzania Academy of Sciences; and Revel Iyer, director of the technology transfer office at Cape Peninsula University of Technology, Cape Town, South Africa.

> "Scientists should not do research just for the sake of doing it, but do something that will make a change in people's lives."
>
> *Esther Mwaikambo, president of Tanzania Academy of Sciences*

Dicko, the recipient of a 2017-2019 TWAS grant, works as an assistant professor in the faculty of agronomy and animal sciences in Mali's capital city of Bamako. He acknowledged the great value of the TWAS grant, which helped to buy the fermenter that he needed to grow the bacteria that are essential to his work.

As he noted, working with microbes brings wider applications: his research might have an important impact on food security, which is a crucial issue in Mali especially when it comes to protecting potatoes and rice from dangerous bacteria.

Looking back to the early days of this successful TWAS' grant programme, it's tempting to fall into complacency. Since 1986, more than 2,580 grants have been assigned that were turned into discoveries, innovative solutions and concrete help for communities. But the spirit of the TWAS Research Grants is even bigger. Says Paoli: "Our programme is committed to consolidating the work of developing countries in the basic sciences for both research and education, which are crucial to sustainable development." ◘

Read more:
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CREATIVE WATER POLICIES HELP COOL TENSION

Israel, Jordan and the Palestinian territories all have one thing in common: an intense need for water. Can this be route to easing tensions in the region?

by **Sean Treacy**

When a team from international environmental group EcoPeace went to a beach in Ashkelon, Israel, in 2016, they didn't find the signs of typhoid and cholera that they were looking for. But they did find something almost as alarming.

Ashkelon, just a few kilometres north of the Gaza Strip along the Mediterranean shore, is home to a desalination plant that produces much of Israel's drinking water. But while there they heard rumours that sewage, which had entered the sea from Gaza, had flowed into the plant and shut it down. They filed for information from the Israeli government to confirm that – and they learned that it was not only true, but had happened multiple times. So they notified local communities, as well as Israeli and international news media. The resulting publicity eventually led to a comprehensive government report in 2017, said Giulia Giordano, international affairs manager for EcoPeace, at the 5th Annual AAAS-TWAS Science Diplomacy Summer Course in August.

If there is one thing that binds the fate of Middle Eastern nations together, it's the desert region's scarcest resource: water. Creating drinkable water relies heavily on desalination – which is a costly, energy-consuming process. But because of this common need, it also provides opportunities to ease some of the region's deepest tensions, even between Palestine and Israel.

Giordano discussed EcoPeace's work using water diplomacy to ease tensions and mend rifts between Israel, Palestinians and Jordan at the 5th annual science diplomacy course in August 2018, held in Trieste, Italy. The event was co-organized by the American Association for the Advancement of Science (AAAS) and the TWAS Science Diplomacy programme.

"If you can effectively pressure the governments that can make an impact on the environment," Giordano explained, "you can do it only by realizing that environment is shared."

MISTRUST, TENSION – AND INTERDEPENDENCE

Life in the Middle East, and especially in the Palestinian territories, revolves around the scarcity of two essential needs: Water, for drinking, and energy, which is needed to create drinkable water.

For nearly 25 years, water for Israel and Palestine has been regulated under the 1995 Oslo II Accord. It was supposed to be temporary, and Palestinians signed it anticipating that it would be replaced in 2000. But the peace process derailed, and Oslo II remained in force. So today, as in 1995, roughly 80% of the drinkable water from the shared Mountain Aquifer goes to the Israelis and 20% to Palestinians.

But there is chronic water scarcity in the West Bank – and in Gaza, the situation is even worse. Ever since Israel withdrew, the Palestinians took control of their own coastal aquifer and began pumping the water from wells. Because they overpumped, highly saline sea water was drawn from the Mediterranean into the aquifer. In addition, the aquifer is contaminated by the untreated sewage of 2 million people. The

▼ Israeli, Jordanian and Palestinian mayors in the Jordan River, a diplomatic gesture taken to promote the river's rehabilitation. (Photo: EcoPeace)

Palestinians now are left with salty, polluted water that is unhealthy for humans to drink. So Palestinians are heavily dependent on water sold by Israel.

Palestinians are also mostly dependent on energy from Israel, and are trying to diversify their energy resources. The Israeli energy industry provides both electricity and diesel fuel to Palestinian companies which use that fuel to generate electricity for Palestinian towns. In Gaza, this amounts to just enough for four hours of electricity a day.

A potential answer lies in Jordan.

BONDS OF PEACE ALONG THE RIVER JORDAN

Neighbouring Jordan is one of the most water-stressed countries on Earth. But Jordan has a lot of desert, which is ideal for solar production. EcoPeace proposed to look at each country's advantages, including Jordan's, and create a community around the most precious resources in the region: water and energy. That approach could deliver benefits to all three nations.

EcoPeace have since joined with private interests to develop a first-of-its-kind project called "Water-Energy Nexus". The proposal is to produce solar energy in Jordan and then transfer it to Israel and Palestine. This could produce the amount of energy needed to provide enough carbon-neutral clean water for the region – and enough energy for other needs as well.

"An Arab state selling energy to Israel could set a precedent for regional integration while producing carbon-neutral water, lowering local pollution, and starting Jordan down the path of becoming a regional force in renewable energy," Giordano said.

> "They decided to take this action and jump into the river to prove they really want a clean and healthy river."
>
> *Giulia Giordano, EcoPeace*

This project is not the only effort at water diplomacy that EcoPeace is engaged in. The Jordan River rides the border between Israel and Jordan, as well as the West Bank and Jordan. But many were unaware that the river is now becoming a sewage channel – at least before EcoPeace started informing the public.

Clearly, the Jordan River Valley has an acute need for sustainable economic development. But the only way to achieve that is to cooperatively share the management of the river. In one part of that effort, EcoPeace organized a regional gathering of mayors, municipal representatives and youth – from Israel, Palestine and Jordan. They built rafts together, and then jumped into the Lower Jordan River with a clear message: governments in the region need to work together to rehabilitate the river.

"They decided to take this action and jump into the river to prove they really want a clean and healthy river," Giordano said. "In there are representatives from Israel, Palestine and Jordan, with different cultural and religious backgrounds, but still they're holding hands, because they all share the same interest." ◘

THE KNOWLEDGE TO GROW SUSTAINABLY

A Finnish microbial ecologist helped Myanmar to develop urgently needed environmental capacity – supported by an ambitious Elsevier Foundation-TWAS sustainability exchange.

by **Sean Treacy**

After nearly a century of economic stagnation and decades of authoritarianism that ended only a few years ago, Myanmar is in a development push, including both political and economic reforms. Today, the country is rapidly transforming.

But growth comes at an environmental cost that Myanmar is ill-equipped to handle. Microbial ecologist Merja Itävaara of the VTT Technical Research Centre of Finland travelled there earlier this year – with support from the Elsevier Foundation-TWAS Sustainability Visiting Expert Programme – to work with local experts to build the nation's environmental sciences.

"In Myanmar, there is a great need for environmental education and especially environmental microbiology and ecotoxicity, which are lacking," said Itävaara. "There is also needed basic education in microbiology, and lab courses to train the students."

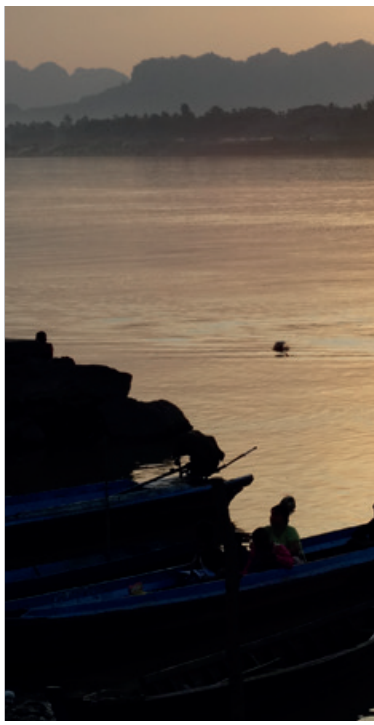
The Elsevier Foundation-TWAS programme provided institutions in developing countries with outside contacts that could lead to strong, long-term links with experts in sustainability science. Itävaara was one of six researchers sponsored in 2017 for such a visit by the programme, aiming to form connections that could lead to further collaborations between European researchers and those from Myanmar. The programme focused on research for sustainability, as well, in an effort to help developing countries achieve the United Nations' Sustainable Development Goals and thrive in a way that will last deep into the future.

"Locally relevant research is vital for solving local issues in specific communities," said Elsevier Foundation Director Ylann Schemm. "International collaboration gives scientists access to resources beyond their own, enabling them to tap larger networks to tackle the challenges their countries face. Working with TWAS, the Elsevier Foundation aims to facilitate knowledge exchange, and support the growth of sustainability science."

"With this programme, TWAS uses science to catalyze sustainable development," said TWAS Programme Coordinator Max Paoli. "A new mindset is required to truly embrace sustainability, so the educational component of the expert's visit is useful. It sharpens Least Developed Countries' ability to focus on local and global challenges."

Myanmar is one of the fastest developing countries in the world. The International Monetary Fund ranked it as having the second-highest growth levels from 2000 to 2016 – ranking only behind China, and driven mainly by agriculture, energy, mining, manufacturing and infrastructure projects.

But as a direct result of poorly regulated growth, agricultural pesticides and fertilizers are polluting waterways, making access to clean water more difficult. Illegal logging is driving deforestation and disrupting local ecosystems. Contaminants such as cyanide and heavy



▲ The ecology of the Thanlwin River in Myanmar has been damaged by a surge of logging in recent years. (Photo: Adam Jones/ Flickr)

metals from Myanmar's ruby and gold mines find their way into rivers, sending those toxic substances directly to local communities.

The country lacks strong standards to control this pollution and its inevitable effects on human and environmental health.

"Locally, the problem is huge," said Itävaara. "There's no environmental research. But we know that the major issue here is to help link with European scientists."

Some international research projects are already underway in Myanmar to address these problems. Most are connected to the Mekong River – an important water source that runs from China through Myanmar and into Laos – and the Inle Lake area. For example, the lake absorbs a large amount of wastewater from surrounding villages where homes lack latrines.

> "International collaboration gives scientists access to resources beyond their own, enabling them to tap larger networks to tackle the challenges their countries face."
>
> *Ylann Schemm, director, Elsevier Foundation*

But current research clearly is not enough. The country's low education level, from childhood to university, has made it difficult for Myanmar to develop the expertise required to keep up with the growth, and environmental research of all kinds is needed to make sure that future growth is sustainable.

Itävaara said Burmese scientists are working hard to elevate the education level of students and young scientists there. "There are several professors who have studied outside Myanmar and have good scientific background and they want to raise the education level of their country eagerly," she said.

And, she added: "To my astonishment, most of the professors are women."

TEACHING MICROBES 101

There was a natural match between Itävaara's expertise and Myanmar's needs.

Her research is focused on how ecosystems function in relation to microbes – for example, how microbial life degrades once-living matter so that the life cycle can begin anew, and how pollutants in the environment can meddle with that process by killing those important microbes.

Myanmar, on the other hand, lacks educational resources and laboratories in the fields of microbiology and ecotoxicity.

While in Myanmar on the Elsevier Foundation-TWAS exchange, Itävaara gave four lectures on environmental biotechnology and biodegradation. Her lectures even included discussion on how to write a grant proposal to secure funding, a process that is not common knowledge among scholars there.

The visit was also an important continuation of a decade of collaboration. Itävaara has known her Burmese colleagues for years, and is trying to strengthen the ties between the research communities of Myanmar and Europe.

"Ten years ago there were no plastics or any Western type of hotels or restaurants," she said. "Children were playing with stones, because there were no toys. The Western type of development has caused huge waste problems and the companies making money should take responsibility." ◘

◀ FIT president Stefano Fantoni (left) discussed cooperation with Royal Society Executive Director Julie Maxton (centre) and TWAS Executive Director Romain Murenzi.

ROYAL SOCIETY MEETS TWAS, FIT IN TRIESTE

by **Cristina Serra**

Meeting in Trieste, three long-time partners look forward to future collaborations to advance the progress of science.

Leaders from the U.K.'s Royal Society visited Trieste, Italy, and met with representatives from TWAS and the Trieste International Foundation for Progress and Freedom (FIT) to discuss new areas of cooperation.

The meeting offered the Royal Society an overview of Trieste's scientific sector, featuring more than 30 national and international centres and over 5,000 resident foreign scientists.

"Science is a global endeavour and few places embody that as well as Trieste," said Royal Society Executive Director Julie Maxton. "Scientific progress is heavily dependent on collaboration and so I am delighted... to meet with TWAS and FIT to discuss how we can continue to work together." Maxton was accompanied by Laura Wilton, head of Europe and Asia in the Society's international affairs office.

"The Royal Society is one of the most respected scientific bodies in the world, and TWAS has long benefited from its partnership in building science in the developing countries," said TWAS Executive Director Romain Murenzi. "We look forward to exploring ways to deepen our cooperation on vitally important scientific challenges."

TWAS, FIT and the Royal Society have connections dating to the 1980s. Among TWAS's 42 founding members was one member from the Royal Society, and FIT sponsored a gala event, the TWAS foundation meeting, held at the University of Trieste in November 1983.

In recent times the Royal Society, TWAS and the Environmental Defense Fund have become partners in the Solar Radiation Management Governance Initiative. The project explores how to govern research into controversial geoengineering technologies that could, in theory, limit global warming by deflecting some sunlight away from Earth.

In 2017, Bai Chunli, the president of TWAS and of the Chinese Academy of Sciences, travelled to London to meet with Sir Venkatraman Ramakrishnan, a Nobel laureate and president of the Royal Society, to discuss joint efforts to build scientific strength in the developing world.

In addition, both TWAS and the Royal Society are active members of the InterAcademy Partnership (IAP), an international body based in Trieste that represents over 130 national and regional science academies.

In 2020 Trieste will host ESOF 2020, a biennial European event where scientists, business leaders, policymakers, science communicators and others will explore the direction that research is taking in the sciences, humanities and social sciences. FIT has been coordinating and promoting Trieste's role as the European capital of science. ◘

Read more: www.twas.org/node/14516/

PEOPLE, PLACES & EVENTS

IN MEMORIAM: CALESTOUS JUMA

Calestous Juma, a Harvard Kennedy School professor from Kenya and a 2005 TWAS Fellow, passed away in December 2017 at the age of 64. Juma rose from a life of challenge, and with a brilliant mind focused on education, innovation and Africa's prosperity, he became a globally influential scholar, policy expert and author.

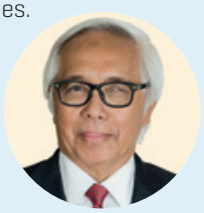
He was a beacon of knowledge and inspiration. Juma's father was a carpenter and his mother an entrepreneur. He grew up on the shores of Lake Victoria with 13 brothers and sisters, but malaria took a deep toll on his siblings. He learned about life's challenges, acquiring curiosity, resilience and a passion for problem-solving. These qualities led him to Harvard University in the United States, where he was a professor of the practice of international development and the director of the Belfer Center's Science, Technology, and Globalization Project. Thanks to his important research on biological diversity, he was named the first executive secretary of the United Nations Convention on Biological Diversity, and was a driving force behind the U.N. treaty to protect the survival of diverse species and ecosystems, signed by more than 150 governments in 1992.

He worked to leverage scientific and technological knowledge in developing countries; with his help, Kenya was among the first countries to use smartphones for money transfer. He authored two seminal books: *The New Harvest* (2015), where he depicted Africa as a reservoir of biodiversity that could help feed the world; and *Innovation and Its Enemies* (2016), where he reminded readers that the adoption of new technologies is largely a process of social learning, which moves from public scepticism to social adjustment.

▲ Calestous Juma, a 2005 TWAS Fellow

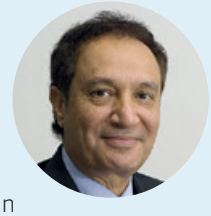
ISLAMIC DEVELOPMENT BANK LAUNCHES NEW FUND

Through the new $500 million Transform Fund, the Islamic Development Bank (IDB) aims to use science, technology and innovation to address challenges that slow progress in developing countries.



The fund was announced at IDB's annual general meeting, held April 2018 in Tunisia.

IDB is a multilateral development bank based in Jeddah, Saudi Arabia. Two TWAS Fellows serve on the bank's scientific advisory board: **Abdul Hamid Zakri** (1996), a science advisor to the Prime Minister of Malaysia since 2010; and **Abdallah Daar** (2007), a professor of public health sciences and surgery at the University of Toronto in Canada.



The guiding principles of the Transform Fund align with six of the 17 U.N. Sustainable Development Goals: greater food security, healthy lifestyle, inclusive and equitable education, sustainable management of water and sanitation, access to affordable and clean energy, and sustainable industrialization across the developing world.

ALBERTO VERJOVSKY WINS SPIRIT OF SALAM AWARD

Alberto Verjovsky, an influential Mexican mathematician and 1988 TWAS Fellow, has been named a winner of the 2018 Spirit of Abdus Salam Award. He received the prize for being highly influential in the development of mathematics in Mexico; he was also a driving force in promoting the establishment of a mathematics section at the the Abdus Salam International Centre for Theoretical Physics (ICTP). The prize is named after Salam, the Pakistani physicist and Nobel laureate who founded ICTP in Trieste, Italy, where TWAS has its headquarters, and is

PEOPLE, PLACES & EVENTS

announced annually on 29 January, Salam's birthday. Verjovsky earned a PhD from Brown University (USA) in 1973, then worked as a research scientist at the Université de Lille, France (1979-1988). He is a senior researcher at the Instituto de Matemáticas, Unidad Cuernavaca, Universidad Nacional Autónoma de México. After his arrival at ICTP in the early 1980s, he worked closely with Salam, persuading him to establish a mathematical section; as coordinator of the section from 1986 to 1993, he encouraged maths research and helped shape the education of thousands of scientists. It honours researchers who have worked to propel science and technology in developing countries.

RAMANATHAN RECEIVES THE TANG PRIZE

Veerabhadran Ramanathan, a globally renowned climate scientist and 2005 TWAS Fellow, has won the 2018 Tang Prize in sustainable development. He is the distinguished professor of climate and atmospheric sciences at the Scripps Institution of Oceanography, University of California, San Diego. The Tang Prize is a biennial award that acknowledges extraordinary contributions in sustainable development, biopharmaceutical science, sinology and rule of law. Ramanathan also is a council member of the Pontifical Academy of Sciences and he represented Pope Francis' delegation to the Paris Summit in 2015 as science advisor. His work has focused on the identification of atmospheric pollutants and on the impact that greenhouse gases have on climate. He has helped to inspire international initiatives such as the Paris climate agreement and the U.N.'s 2030 agenda for sustainable development. Born in India, Ramanathan is a member of the U.S. National Academy of Sciences, the Royal Swedish Academy of Sciences and the Indian National Academy of Sciences. He was named the champion of earth in 2013 by the United Nations Environment Program. He shared the prize with James E. Hansen, the former director of the U.S. National Aeronautics and Space Administration (NASA) Goddard Institute for Space Studies

PADRÓN ELECTED TO US NATIONAL ACADEMY OF SCIENCES

Raúl Padrón, a Venezuelan structural biologist elected to TWAS in 2004, was elected as a foreign associate of the U.S. National Academy of Sciences in 2018. Padrón is recognized for his work on the basic structure of the myosin thick filaments of muscle and the myosin interacting-heads motif, with implications on muscle relaxation and activation. Padrón was a postdoctoral fellow at the MRC Laboratory of Molecular Biology (Cambridge, U.K.). He joined the Venezuelan Institute for Scientific Research in Caracas, Venezuela, where he founded the Center of Structural Biology and where he is an emeritus investigator.

IN MEMORIAM

Giancarlo Ghirardi, a 2003 TWAS member and one of the founding fathers of the Abdus Salam International Centre for Theoretical Physics (ICTP), passed away in June 2018. A world-renowned physicist, Ghirardi's name is linked to the physical theory formulated with colleagues Alberto Rimini and Tullio Weber, thereby called GRW theory, and also made contributions to the foundations of quantum mechanics. He was a full professor at the University of Trieste, a member of the academic board of ICTP in Trieste, and the president of the "Consortium for promotion and progression of knowledge and investigation in physics". He was also the president and a founding member of the Italian Society for the Foundations of Physics. Among his honours: the Prize of the Italian Physical Society (1959) and the Primo Rovis Prize for Science Popularization (2000). Two seminal books he wrote are: '*Un'occhiata alle carte di Dio. Gli interrogativi che la scienza moderna pone all'uomo*' (1997) and the other on symmetry '*Simmetrie. Principi e forme naturali*' (2018).

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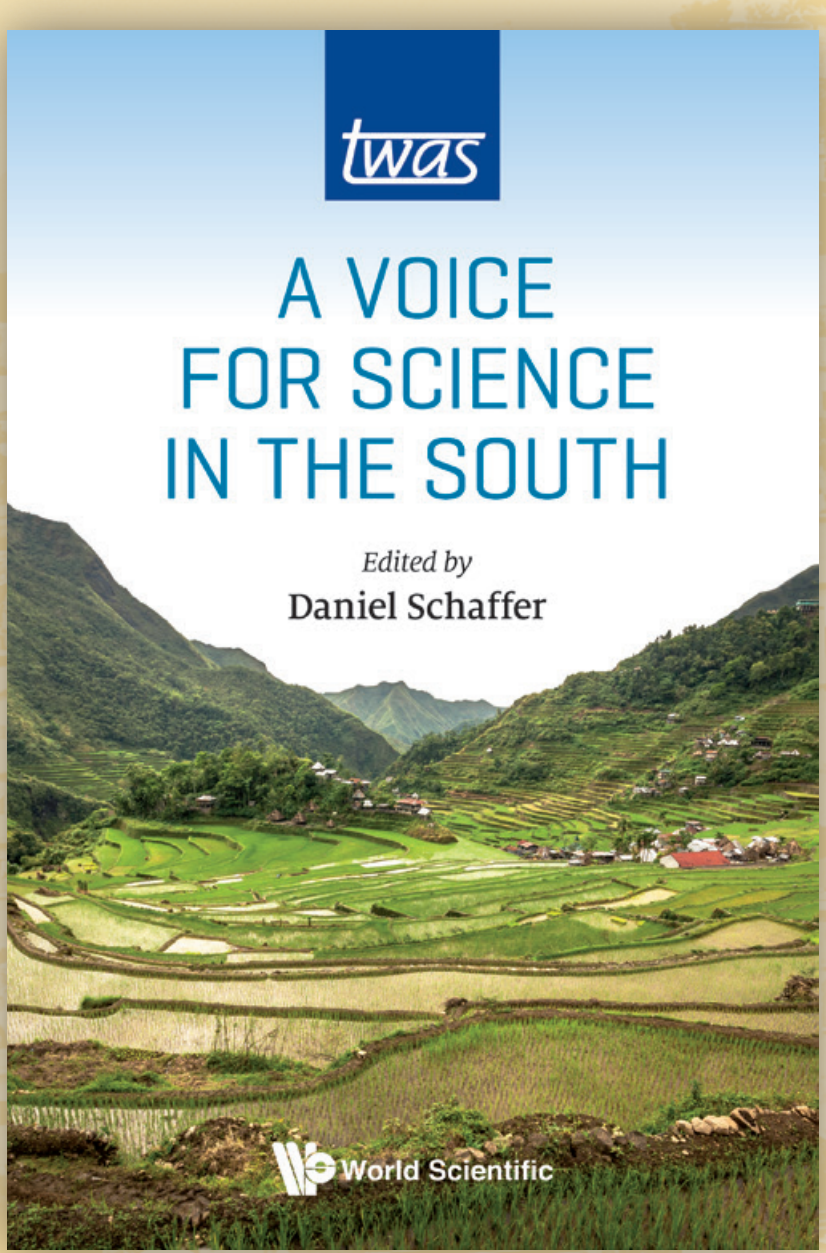

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The World Academy of Sciences for the advancement of science in developing countries – TWAS – works to support sustainable prosperity through research, education, policy and diplomacy.

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 about 1,220 elected Fellows from nearly 100 countries; 14 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, the Academy'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 over 490 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 two 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 6,000 members. Their objective is to strengthen the role of women in the development process and promote their representation in scientific and technological leadership.

The InterAcademy Partnership (IAP) represents more than 130 academies worldwide. IAP provides high-quality analysis and advice on science, health and development to national and international policymakers and the public; supports programmes on scientific capacity-building, education and communication; leads efforts to expand international science cooperation; and promotes the involvement of women and young scientists in all its activities.

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