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N E W S L E T T E R
A PUBLICATION OF THE WORLD ACADEMY OF SCIENCES



TWAS Fifteenth General Conference

The Academy's keystone event was held
entirely online for the first time

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▲ Roseanne Diab, an Emeritus Professor at the School of Environmental Sciences of the University of KwaZulu-Natal, in Durban, South Africa, speaking at TWAS Fifteenth General Conference.

▼ Images shown by TWAS Medallist Mandyam Srinivasan during his lecture of 3 November 2021 at TWAS Fifteenth General Conference, detailing his research on the vision of bees and birds. [Image provided]





EDITORIAL

WHY A GENERAL CONFERENCE?



▲ Raffaella De Lia,
Twas Editor & Public
Information Officer

In a radio interview with a journalist of the Italian national public broadcasting company, RAI, I was asked a simple question on TWAS Fifteenth General Conference. A question that made me realize that what we, international civil servants, take for granted, may in fact be everything but. Let me clarify. The simple question was: What is the purpose of a general conference? I was taken aback. From my perspective, it was like asking a student “Why do you have a backpack”, or a parent “What do you need a car for”? You get the gist.

It then dawned on me that, often, starting from the basics is actually very useful in my line of work—communications—particularly when being responsible for the communications of an academy of sciences. The *basics* in this case can make all the difference between sending out a clear, understandable message and the exact opposite.

General conferences usually consist of the representatives of an organization’s membership, which in the case of UNESCO-TWAS is its Fellows and its Young Affiliates. General conferences are usually convened regularly, in the case of UNESCO-TWAS every two years—even though COVID-19 threw the usual schedule off. General conferences determine the policies and the main lines of work of an organization, in brief the way ahead. They also serve the purpose of taking stock of, and taking decisions on, internal matters such as budget and new members—activities that at TWAS General Conferences are dealt with in the segment called General Meeting.

More specifically, each TWAS General Conference is designed to survey, research and exchange successes and powerful ideas that shape science in the South, as well as explore lessons learned from the past, and find solutions to current challenges. A leading public official of the host country usually delivers the opening address. A ministerial session, devoted to critical scientific issues, is usually held. Scientific

symposia, focusing on topics ranging from agriculture to biotechnology to materials science, are held throughout. In other sessions, young promising scientists are given the opportunity to discuss their research. And a series of awards and medals acknowledge the excellent work done by scientists in developing countries.

Clarified the basics, this entire issue of TWAS Newsletter is dedicated to TWAS Fifteenth General Conference. Each article will take you inside the Conference by hand, so to say, and give you the sense of the different segments and of the exciting findings of participating scientists.

TWAS General Conference—held this year entirely online and one year after the original schedule due to the COVID-19 pandemic—gathered approximately 600 participants per day from 80 countries, and it featured 50 outstanding speakers and 36 distinguished awardees. And it was made possible by the relentless work of approximately 90 staff cooperating across three countries—Italy, where TWAS Secretariat is located; Saudi Arabia, where the main organizing entity is located; and India, where the company that built the Conference platform is located. This means that, considering the different time zones, for the three months immediately prior to the Conference, there was someone working round the clock to make this momentous gathering not only possible but also a success: a peaceful global ‘army’ at the service of science.

So, going back to the initial question posed by the RAI journalist about the purpose of a general conference, could I answer it today, I would say that such conferences are like big family gatherings, with all their enthusiasm and all the seriousness of facing challenges together. And, exactly like families do, each family member works towards common goals. TWAS Fifteenth General Conference was definitely one of those gatherings.

Raffaella De Lia
Editor & Public Information Officer

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IN THE NEWS

India pledges billions for virus research

As India battles one of the world's largest COVID-19 outbreaks, the Indian Government pledged a considerable part of its budget to fund virology research and biosafety. The Department of Health Research will receive 26.7 billion Indian rupees [\$365 million] this year, a rise of 5.6 billion [27 per cent] over last year's budget. The pledge will fund four new national virology institutes, nine new high-containment laboratories for studies on highly infectious pathogens and a national institution to coordinate research and surveillance.

Nature News:

www.bit.do/IndiaBudget

Nine African nations on track to join solar 'gigawatt club'

Of the 37 countries that are part of the solar 'gigawatt club', only two—South Africa and Egypt—are from Africa. But this might change soon with nine more African countries ramping up solar capacity, said the first annual African Solar Energy Outlook 2021 report released by the Africa Solar Industry Association.

The nine countries that are developing their solar infrastructure are Algeria, Angola, Botswana, the Democratic Republic of the Congo, Ethiopia, Morocco, Namibia, Zambia and Zimbabwe.

Down to Earth:

www.bit.do/GigawattClub



Malaria data opened up to combat drug resistance

A huge trove of aggregated data on malaria parasites from around the globe is unlocking genetic secrets on the organism's evolution and could assist in the mounting battle against drug resistance, experts say.

Scientists analysed genetic variations of 7,000 *Plasmodium falciparum* parasites from 28 countries, and curated the data to make them accessible to other researchers, including those without expertise in genetics.

SciDev.Net:

www.bit.do/MalariaData

COVID-19 lockdown highlights ozone chemistry in China

Despite lockdown measures to slow the spread of COVID-19, environmental researchers noticed that ground-level ozone pollution in Beijing and the Northern China Plain skyrocketed, even though NO_x, a component of ozone, decreased. Researchers from the Harvard John A. Paulson School of Engineering and Applied Sciences and the Nanjing University of Information Science & Technology found that another component of ozone, volatile organic compounds, may be to blame for the increase in winter ozone.

Harvard John A. Paulson School of Engineering and Applied Sciences News:

www.bit.do/ChinaOZone

Scientists may have discovered chimp-killing disease

For years, scientists have observed a mysterious infection swiftly killing chimpanzees at a lush sanctuary in Sierra Leone's rainforest. Even when veterinarians gave ill chimps antibiotics and fluids, wrapped them in warm blankets, and isolated them in smaller enclosures, they died. Now, after studying tissue samples and DNA from chimpanzees at the sanctuary, researchers have identified the likely culprit. In *Nature Communications*, they report that a new species of clover-shaped bacterium infected tissue samples from 13 chimps that died.

Science Magazine:

www.bit.do/ChimpsDisease



ACCOMPLISHMENTS FROM THE ALL-VIRTUAL

TWAS FIFTEENTH GENERAL CONFERENCE

جامعة الملك عبد
للعلوم والتقنية



HIS EXCELLENCY
DR. MUNIR
M. ELDESOUKI



PROF. JEAN-MARIE
LEHN




The virtual lobby of the platform that 'hosted' TWAS Fifteenth General Conference simulated the real lobby of the King Abdullah University of Science and Technology (KAUST), the institution that 'hosted' the Conference.



HER EXCELLENCY
MARINA SERENI



Months of planning and cooperation between TWAS and the King Abdullah University of Science and Technology culminated in a successful online event

 by **Cristina Serra** and **Sean Treacy**

From 1–4 November, The World Academy of Sciences (UNESCO-TWAS) convened its Fifteenth General Conference in an all-virtual form, after over eight months of planning with two important partners based in Saudi Arabia, the King Abdullah University of Science and Technology (KAUST) and the Islamic Development Bank (IsDB).

The event, titled “Advancing frontier science, technology and innovation for the SDGs in developing countries”, was originally planned to take place in person in 2020 at KAUST, in Jeddah. Because of the COVID-19 pandemic, it was held online one year later. The Conference was still coordinated by KAUST, along with TWAS Secretariat in Trieste, Italy, and with the support of IsDB. KAUST granted the technical infrastructure through a set up by Streamy, an India-based service provider. IsDB, also based in Jeddah, has been providing UNESCO-TWAS with funding since 2019, with a focus on building capacity in IsDB least developed member countries.

The General Conference drew an international audience of scholars, young researchers and policy experts, totalling an average of 600 participants per day, who connected from more than 80 countries.

ACKNOWLEDGING SCIENTIFIC VALUE

The event started on 1 November with the General Meeting of TWAS Fellows and TWAS Young Affiliates, who discussed matters internal to the Academy, after which the opening ceremony of the Conference took place. Presented by TWAS Editor and Public Information Officer Raffaella De Lia, eight distinguished speakers delivered their opening remarks.

The first message came from TWAS President, Prof. Mohamed Hassan. Reflecting on the last two years, Hassan noted that a remarkable body of scientific evidence on pandemics was available in scientific literature before 2020, yet the world was taken ‘by surprise’. “This is why—he said—science literacy is essential to decision makers.”

Her Excellency Marina Sereni, Vice-Minister of Foreign Affairs and International Cooperation of Italy highlighted the synergy between the Government of Italy and UNESCO-TWAS. “International research centres such as TWAS can become crucial tools of foreign policy,” she said. “Italy is proud of hosting TWAS in Trieste, and acknowledges the Academy’s global leadership in the field of scientific capacity-building, women, youth empowerment and sustainable development.”

Dr. Kerstin Jonsson Cissé, Head of Unit for Research Cooperation of the Swedish International Development Cooperation Agency (Sida), said that “Sida appreciates very much the flexibility that TWAS has in its work for the grantees in science- and technology-lagging countries. During the last years, we have witnessed how TWAS enabled scientists to pursue their work during the COVID”. Sida has been a UNESCO-TWAS steadfast partner since 1991.

In the following segment of the Conference, TWAS Secretary-General, Prof. Luiz Davidovich introduced a total of 36 awardees, who received international recognition for their scientific achievements. The awards included TWAS-Lenovo Science Award, offered by Lenovo, the PC company; TWAS Awards, acknowledging impactful research in nine different fields; and awards offered by TWAS Fellows to celebrate



scientists who made significant contributions in selected fields.

The end of the first day was marked by the keynote lecture, titled “Steps Towards Life: Chemistry!”, delivered by Nobel Laureate Prof. Jean-Marie Lehn of the Institute of Supramolecular Science and Engineering of the University of Strasbourg, France [see pp. 10–11]. Lehn was awarded the Prize in chemistry in 1987, jointly with two other colleagues.

GLOBAL INEQUALITY IS A GLOBAL CHALLENGE

A high-level Ministerial Session opened the second day of the Conference, on 2 November. The theme “Financing frontier science, technology and innovation for the SDGs” spurred vibrant reflections on the challenges posed by COVID-19, climate change and sanitation, to name a few, prompting speakers to share experiences about national policies on investments in science and technology, and examples of how frontier science can be instrumental in reducing inequalities.

Prof. Eric Lander, Science Advisor to the US President and Director of the White House Office of Science and Technology Policy, applauded UNESCO-TWAS recent work to help rescue and resettle refugee scholars from Afghanistan. “We need to include, elevate and embrace the unique perspectives of people doing science all around the globe: ideas born in Kigali or Kampala can teach people in California or Kentucky, and vice versa,” he said.

His Excellency Dr. Munir Eldesouki, Assistant Minister at the Ministry of Communications and Information Technology of Saudi Arabia and Acting President of the King Abdul-Aziz City for Science and Technology urged to reconcile a new science and technology through nature, with investments in technological innovation that are sustainable, and not only driven by economic growth.

At the end of the day, Symposium 1 on “Advancing frontier science, technology and innovation for the SDGs in developing countries” addressed issues that link energy, climate change and transformative practices to achieve real sustainability worldwide. Prof. Carlos Nobre—one of the authors of the Fourth Assessment Report of the United Nations

Intergovernmental Panel on Climate Change, which received the Nobel Peace Prize in 2007—was one of the speakers [see pp. 12–13].

DIGITAL INCLUSION IN THE POST-COVID ERA

On the third day—3 November—Symposium 2 on “The world facing COVID-19” examined different aspects of the recent pandemic [see p. 20]. The urgency of sharing knowledge, and implementing collaboration and partnerships emerged as being of the utmost importance.

Case studies were brought from South Africa, Bangladesh and Brazil, and new research about a protein subunit vaccine against COVID-19, now in the pipeline, was presented. Three Medal Lectures [see pp. 14–19] and a session on visual explanations of scientific papers—posters—concluded the day.

Symposium 3, titled “Digital inclusion: Challenges and opportunities for connecting the unconnected in the post-COVID era”, opened the final day. One of the main conclusions was that the inequalities exacerbated by the pandemic could lead to the exclusion of those who are not digitally connected, the ‘offline population’, which, according to figures provided at the symposium, amounted to about 4 billion people—approximately half of the world population.

The induction of TWAS Fellows elected in 2019, 2020 and 2021, and the introduction of TWAS Young Affiliates appointed in those same years concluded the Conference programme [see pp. 21–23].

The results of all the findings and dialogues of the Conference converged into an outcome document called the Jeddah Declaration [see pp. 7–9], officially adopted during the closing ceremony. The main action points of the Declaration—on curbing and reversing inequalities, climate change, biodiversity, gender, COVID-19, science literacy, and digital inclusion—were deliberately self-explanatory.

KAUST President, Prof. Tony Chan, in his closing remarks, said that “inclusivity and equity are non-negotiable elements [...] to achieve global sustainability. It is, therefore, essential that we collect pathways to communicate, and exchange ideas and perspectives. TWAS has provided all of us with a very powerful platform precisely for this exchange of ideas.” ■

Jeddah Declaration of TWAS Fifteenth General Conference

At the end of TWAS Fifteenth General Conference, participants drafted guiding principles that, building up on the lessons learned from the past, orient the future direction of science, technology and innovation

Adopted on 4 November 2021

PREAMBLE

The Fifteenth General Conference of The World Academy of Sciences [UNESCO-TWAS] for the advancement of science in developing countries was successfully convened online from 1 to 4 November 2021.

We, the participants, focused on the theme of “Advancing frontier science, technology and innovation for the SDGs in developing countries”.

We, the participants to the Conference:

Recognizing the vital role that science, technology and innovation play in addressing global challenges, such as efforts to eradicate poverty, achieve food security, fight diseases, improve education, facilitate access to clean energy, accelerate economic growth, protect the environment, and ultimately support sustainable development, particularly in the least developed and science- and technology-lagging countries;

Recognizing that science, technology and innovation are vital for the implementation of the 2030 Agenda for Sustainable Development and the achievement of the 17 Sustainable Development Goals [SDGs], which aim to achieve socially inclusive economic development within the boundaries of the Earth’s capacity to sustain human activity;

Inspired by the transformative vision of Sustainable Development Goal 17, unique in that it encompasses

all the other goals, calling, as it does, for a revitalization of global partnerships for sustainable development;

Further inspired by target 6 of Sustainable Development Goal 17 on enhancing North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation, and on enhancing knowledge-sharing;

Recognizing the central role that TWAS must play in supporting scientific excellence, by helping to build research capacity in the developing world, and by actively participating, in partnership with other international scientific organizations and miscellaneous stakeholders, in the endeavour to tackle the global challenges addressed by the SDGs;

Reaffirming the Academy’s will, in the next four years, to pay special attention to promoting science-technology-and-innovation [STI] strategies and policies for the implementation of the SDGs, as outlined in Strategic Priority 6 of “TWAS Sixth Strategic Plan [2021-2025]” on promoting STI and science-policy-diplomacy links for the achievement of SDGs;

COVID-19

Considering that the outbreak of the COVID-19 pandemic showed the importance of making advances in science and technology available and accessible to all;

Considering also that, in light of the consequences of the global COVID-19 pandemic, strengthening multilateralism and global partnerships is of critical importance;

Recognizing that the SDGs remain the framework for building back better jointly with governments, civil society, scientists, academia and the private sector;

Considering that COVID-19 revealed that there is extensive room for improvement in the way science and technology are harnessed worldwide to resolve global challenges, and that achieving the SDGs by 2030 requires most countries to swiftly realign their national priorities towards collaborative and longer-term planning;

Recognizing the importance of the connection between the pandemic recovery and contributions of science towards SDGs, the realization of which would be impossible without international cooperation;

Recalling TWAS Statement on COVID-19, released on 9 April 2020, which indicated that solutions must include medical professionals, public health officials tracking the virus, and researchers engaged in the development of treatments, because health-service disruptions could reverse decades of improvement and affect peoples' health for years to come, particularly in the developing world;

Recognizing that unless we share the vaccine globally, we will continue to share the virus, and that in the present global society one is safe only until everybody is safe;

OPEN SCIENCE

Recalling the principles of 'open science', as outlined in UNESCO draft Recommendations on the development of the first international standard-setting instrument on open science and adopted by consensus in May at an intergovernmental meeting that saw the participation of 106 countries represented by 230 experts;

Recalling that those recommendations will be submitted for final adoption by all 193 UNESCO Member States to UNESCO Forty-first General Conference, taking place from 9 to 24 November;

Noting that 'open science' means promoting collaboration across disciplines and, above all, across geographies, and that this is particularly critical for developing countries, "where resources are scarce, scientific infrastructure remains underdeveloped,

and health-care services are under-resourced"—countries that may otherwise find it difficult to participate in the latest research;

Recalling that TWAS is one of the science stakeholders in UNESCO Global Open Science Partnership;

Recalling also Article 27 of the Universal Declaration of Human Rights which affirms that: "Everyone has the right freely [...] to share in scientific advancement and its benefits";

Call, therefore, for an ambitious commitment of all stakeholders and unanimously declare that:

On curbing and reversing inequalities

- Encourage long-term and continued investment in science institutions and programmes focusing on developing countries, so to reduce global inequalities, such as poverty or unequal access to health. According to United Nations data, three quarters of people who do not have access to electricity are in Sub-Saharan Africa: inequalities worldwide continue to exist and many least developed countries need greater and better support.
- With the same aim of reducing inequalities, science institutions, on their side, shall promote and encourage exchanges among scientists—South-South, North-South, and South-North.

On energy, climate change, and green technologies

- Given the interlinks between energy and climate, decarbonization efforts must increase to speed up the process of ecological transition. Methane emissions should be taken into account routinely in all processes, discussions and decisions on green technologies, as they play a crucial, but often overlooked, role in climate change.
- The unsustainable use of resources is another global pandemic: all countries must become more accountable for their footprint on the planet. Agri-food systems also need to be reprogrammed according to sustainable practices.

On biodiversity, biotechnology, and health

- Biodiversity is well known for its potential in drug discovery, and this has tremendous potential for developing countries. It is a most valuable resource for human civilization: it must be re-evaluated in all

its forms with the new knowledge emerging from recent scientific research, for instance regarding soil biodiversity. It is a true frontier of science: it can teach us important principles that can help us solve real-life problems, for example in relation to plant health and food production.

- Biotechnology has a wide range of applications, useful for health, renewable energy, and food security, particularly for developing countries. This should be made clear to society and policymakers.

On gender

- Build on the concept of gender-responsive scientific organizations, namely organizations that raise gender equality higher on their agenda; help achieve parity by sharing examples of good practices, and establish short- and long-term mechanisms for more inclusive assemblies; create enabling and inclusive environments for meaningful and substantive participation of women and the advancement of gender equality; promote and encourage gender equality at the senior level; develop and apply policies that advance gender equality. Such an approach is particularly needed in science.
- Academies around the world to promote gender responsiveness commitments, allocation of funds and, more importantly, actions to transform the behaviour of institutions, at all levels, but particularly at the highest level of management, and achieve and encourage gender equality.

On COVID-19

- COVID-19 has increased poverty with over 150 million more people in poverty: solidarity is an ethical duty for wealthier countries to support least developed countries.
- Inequality has been clearly highlighted by COVID-19 also in terms of vaccine access and distribution: unless we share the vaccine globally, we will continue to share the virus.
- The benefits of the scientific success that brought the first COVID-19 vaccine in nine months were unequally distributed: only 5 per cent of the African population is vaccinated, and many developing countries are still left behind.
- Preparedness is key to address future pandemics: this requires international collaboration and conferences involving participants from developed

and developing nations, as well as an efficient global governance ready to promote the fast dissemination of knowledge and the distribution of tests and vaccines.

On science literacy and information

- The pandemic highlighted that entire groups of society worldwide are negatively affected by, and act upon, fake news and conspiracy theories, known as ‘infodemic’—too much information, including false or misleading information in digital and physical environments, during a disease outbreak. Such information creates confusion, and brings about risk-taking behaviours that can harm health, leads to mistrust in health authorities and science, and can thus intensify or lengthen outbreaks. The promotion of the systematic use of risk- and evidence-based analysis and scientific approaches to reduce the negative impact of infodemic on health behaviours is thus crucial. Misinformation kills: scientists and policymakers need to communicate and cooperate more than ever before. This requires a special effort to overcome science illiteracy.
- Science institutions, in cooperation with policymakers, should promote basic and non-basic science literacy globally, at the level of laypersons, investing in and promoting science communication targeting scientists. Scientists’ ability to convey the principles and outcomes of science is crucial in spreading, shaping and consolidating science literacy in non-scientific communities worldwide, ranging from policymakers to the general population.

On digital inclusion

- International organizations and scientific societies should help digital inclusion through the dissemination of affordable equipment and educational techniques based on digital practice. While digital transformation is opening opportunities for advancing social progress and fostering social inclusion, it is simultaneously exacerbating the risk of increased inequalities and exclusion of those who are not digitally connected, namely the offline population, which is disproportionately female, rural, poor, comprised of older persons, and/or with limited education and low literacy. ■



Q&A ALL IS CHEMISTRY

 by Cristina Serra

In his keynote lecture at TWAS Fifteenth General Conference, Nobel Laureate Jean-Marie Lehn shares his considerations on the evolution of chemistry and the importance of science

Jean-Marie Lehn, a 1987 Nobel Prize winner and a TWAS Fellow since 1996, was a keynote speaker at The World Academy of Sciences [UNESCO-TWAS] Fifteenth General Conference. The event was organized by the King Abdullah University of Science and Technology [KAUST] in collaboration with the Islamic Development Bank [IsDB], from 1–4 November, and was, for the first time, in an all-virtual mode.

In his lecture titled “Steps Towards Life: Chemistry!”, Lehn retraced the most meaningful phases that turned the old-fashioned chemistry into a new branch called ‘supramolecular’ and which deals with the way molecules associate and dissociate to form new structures, with different properties. The lecture was chaired by TWAS Secretary-General, Luiz Davidovich.

From the beginning of his scientific career, Lehn was fascinated by the way molecules recognize each other, bind and ultimately form organisms who can ‘think’. For his insights and discoveries, in 1987 he shared the Nobel Prize in chemistry with Donald J. Cram and Charles J. Pedersen. The recognition was bestowed “for their development and use of molecules with structure-specific interactions of high selectivity.”

Lehn obtained his PhD in 1963 at the University of Strasbourg, France, and a post-doctoral position in 1972 at Harvard University, USA. From 1970–1979, he was Professor of Chemistry at the Université Louis Pasteur in Strasbourg, and since 1979, he is Chair of Chemistry of Molecular Interactions at the Collège de France in Paris.

In the following interview, Lehn addressed key issues, such as the power stemming from modern chemistry and the benefits coming from the proper use of science.

Professor Lehn, what may we expect from a dynamic field like chemistry, in 20–30 years from now?

● Scientists should be very cautious when observing what lies ahead, because things happen in unpredictable ways and a discovery in one sector may suddenly have an impact on another sector. Scientists start from the structure of matter, transform it, and then study how the information contained in the structure is processed through novel interactions with the surroundings. I think this will be a major trend of chemistry in the near future: a path towards higher states of complex matter.

Early in your career, well before the Nobel Prize, did you ever dream of making such an impact in this sector?

● In 1965, I set up my laboratory and then, aside from the initial main lines of research in physical organic chemistry, I started looking for a phenomenon occurring in the nervous system that a chemist like myself could study. And I found it in the chemical basis of the action potential.

Where did you start from?

● I started from the way our nerves work: they propagate information through an electrical impulse, called the action potential, which travels along the nerve and relies on the flow of sodium and potassium ions across the membrane. It was clear from the beginning that there had to be a mechanism able to discriminate between the two ions. So, my major question became: how can we make compounds that distinguish two molecules? That was the right question. The Nobel Prize citation is, in fact, about molecular recognition.

What is molecular recognition?

● It's a matter of fitting things together, like a lock and a key. If you have the right key for a lock, you can enter a room. In this case, it's about ions entering a cell, or more generally about molecules that stick together

with great selectivity, but then can disengage. This is precisely what we are doing now: we study supramolecular chemistry, which is a dynamic form of chemistry, where objects [the molecules] associate and dissociate to form new structures, with different properties.

Science is independent of any system, religion, politics, belief. And the spirit of science—the critical mind, a rational, evidence-based approach—is very important.

Jean-Marie Lehn



What would be interesting applications of supramolecular chemistry to the most urgent problems affecting the world?

● An important application would be energy production without pollution, and electricity is the least polluting form of energy, except for the fact that to produce it, one has to avoid polluting activities like burning coal. An ideal procedure would be to store solar energy in molecules. If we could dissociate with light a water molecule into two atoms of hydrogen and an atom of oxygen, and re-associate them back at will, that would be a good way to store energy, like in photosynthesis. But we are far from obtaining artificial systems able to dissociate molecules to produce energy economically.

Could modern chemistry heal what it did wrong in the past?

● I'd say that it hasn't been chemistry to pollute our world: people have polluted their environment. Today, there is more awareness about chemical pollution, but people should be more careful as well.

As you said, it's not science that is dangerous, but how it's used. What could be potential risks stemming from the inappropriate use of chemistry?

● The first and most important element is "population". Our planet is very crowded, and this poses big problems. Better cultivations and better yields are needed, and we have many tools that can be used safely. What happens, however, is that oftentimes too much of an efficient chemical compound is used because one thinks that more is better. We should invest in training to understand how to safely use chemistry, and in information to make sure that it is



▲ Nobel Laureate Jean-Marie Lehn during the virtual interview with TWAS Staff Writer Cristina Serra, on 25 October 2021.

applied. Genetic modifications of plants are also very powerful and should, and will, be used more and more.

Should you wish to attract students to embrace science in their university curricula, what would you leverage?

● Science is independent of any system, religion, politics, belief. And the spirit of science—the critical mind, a rational, evidence-based approach—is very important. Science shapes the future of humanity and I'd say to them: Participate!

Chemistry is everywhere, but people underestimate its importance in life. Do you have a take-home message to promote a better understanding of its role and importance?


● We have a heart and emotions, which give flavour to our life. But they can also be very dangerous. Our main, highest-level organ is the brain. We still don't know how to make good use of it. This is where science comes in. Science is about facts. Chemistry is about facts. And we should not forget that we too are molecular objects, extremely complex molecular objects. ■

Read more: <https://twas.org/node/15244/>



A RAINFOREST NEARING ITS TIPPING POINT

Better economic planning is the best chance to help bring the Amazon rainforest back from the brink of destruction, says Carlos Nobre at TWAS Fifteenth General Conference

 by Sean Treacy

The Amazon rainforest is one of the world's great natural wonders, covering millions of square kilometres and crossing borders into eight different South American nations—Brazil, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guyana and Suriname—and French Guiana, a territory of France. According to Brazilian Earth system scientist Carlos Nobre, however, the 'lungs of the planet'—as the Amazon is often referred to—are under threat from deforestation, forest degradation and wildfires that could result in a "tipping point" that they might never recover from. And to keep this from happening, he said, scientists and policymakers must innovate to find a new sustainable balance between nature and the modern economy.

Nobre has been a TWAS Fellow since 2006, and was one of the authors of the Fourth Assessment Report of the United Nations Intergovernmental Panel on Climate Change that was awarded with the Nobel Peace Prize in 2007. He spoke at TWAS Fifteenth General Conference on 2 November, as part of a symposium titled as the Conference itself: "Advancing frontier science, technology and innovation for the SDGs in developing countries". In his lecture and in a separate interview, he detailed the challenges the Amazon faces, and the unprecedented solutions that must be found to save it.

The Amazon rainforest, he said, has already lost 1 million out of 6.2 million square kilometres to deforestation, and 1 million more to wildfires and forest degradation. "Many

studies have shown there is a possibility that we are very close to a tipping point in which only the western Amazon near the Andes would remain—30 per cent of the forest," he said. "The other 70 per cent would become a highly degraded, open-canopy ecosystem."

If that tipping point is reached, continued Nobre, up to 70 per cent of the forest will be "savanna-like" in 30-50 years. The process is called "savannization", which means thinner canopies, wider grasslands, dryer terrain, and thus more fires sparked in areas with dry vegetation.


Further, if that tipping point is allowed to occur, more than 300 billion tons of carbon dioxide will be released into the atmosphere, making it impossible to reach the target set by the Paris Agreement, adopted by 196 parties in December 2015, and enhanced by COP26 in November 2021 in Glasgow, of limiting global warming to 1.5 degrees Celsius. It would also mean the extinction of thousands of plant and animal species. And the climate stability of South America, which the Amazon is essential for, will be severely disrupted. The local average temperature would increase by as much as 3 to 4 degrees Celsius, and droughts would accelerate.

The Amazon is already under direct pressure from droughts caused by climate change. Droughts used to happen every 15-20 years, Nobre noted, with a severe one perhaps once per century. Now, droughts occur closer to every five years, which causes and accelerates the fires and rate of forest degradation.

▶ Earth systems scientist Carlos Nobre delivering his presentation on the Amazon 4.0 Project at TWAS Fifteenth General Conference, on 2 November 2021.

The effort to stop this tipping point from arriving faces major hurdles. Nobre said most of the deforestation in the Amazon is already illegal, much of it run by organized crime interconnected across South American countries. Of the land destroyed by clear-cutting, 63 per cent was made into pasture land for cattle, and 23 per cent was completely abandoned. Nonetheless, most of the farmers and ranchers who buy the land from criminal organizations are poor and need better economic opportunities.



“We need to add the forest to supply chains, with modern technologies and bioindustrialization, to create high-quality jobs.”  Carlos Nobre

“I have to say, the big agricultural industry always wants to expand. But very little wealth remains in the Amazon,” said Nobre. That expansion “doesn’t bring well-being for most of the Amazon population—about 40 million people, 2.5 million of them indigenous. About 60 per cent of the population is very poor.”

To tackle this problem, Nobre asked a key question: What is the economic value of the standing forest?


Read more:
www.twas.org/node/15250/

It turns out that, with the right strategy in place, the forest has a wealth of resources that could be turned into an economic engine: cacao for chocolate and other edible goods like Brazil nuts are only two examples. Also, over 240 plant species of the Amazon are also useful for cosmetic and pharmaceutical products, and the full potential of the standing forest is yet unknown. Nobre estimated the rainforest’s natural resources are at least five times more valuable than the cattle ranching or soy farming that result from the clear-cutting operations.

Nobre said scientists and policymakers must tap into the principles of the so-called Fourth Industrial Revolution to harness the tremendous potential of the Amazon, with 450 species of known economic value that should easily surpass the value of cattle or soy. But they must do so sustainably, maintaining the rainforest’s rich biodiversity.

“We need to add the forest to supply chains, with modern technologies and bioindustrialization, to create high-quality jobs,” Nobre said. “That is why, a big challenge is how to combine this with the knowledge of indigenous peoples, who always kept the forest standing, and extract everything they need from it.”

Nobre is part of a team developing what they call Amazon 4.0 Project, a strategy for coupling the latent economic potential of the Amazon’s social and biological diversity with new technologies and opportunities afforded by the fourth industrial revolution. The project will include creative labs for developing sustainable uses of the rainforest’s resources like cacao and Brazil nuts. It will also include plans for a rainforest social business school. But the biggest part of the challenge is that such an effort would be unprecedented. There is no model to copy, said Nobre, so the situation calls for radical innovation.

“Basically, we need to bring the ways of developing new knowledge, new technology, and also combine it with traditional knowledge,” said Nobre. 



PAVING THE FUTURE THROUGH BIOTECH

In a lecture at TWAS Fifteenth General Conference, influential Arab scientist and TWAS Medal winner Hayat Sindi illustrates the pivotal role of biotechnology in the human path

 by Cristina Serra

Biotechnology is ‘learning’—and will ‘learn’ even more—how to develop new technologies that improve our lives from cells and biomolecular processes. These auspicious words were spoken by Hayat Sindi, Chief Advisor for Science, Technology and Innovation to the President of the Islamic Development Bank [IsDB], on 3 November, at the opening of her Medal Lecture, at TWAS Fifteenth General Conference [1–4 November].

Sindi received the prestigious TWAS Medal for her achievements in biotechnology. TWAS Medals are prestigious recognitions that TWAS Fellows receive for their outstanding accomplishments in science. Sindi, one of the most influential Arab scientists ever, was awarded the Medal exceptionally—as she is not a TWAS Fellow—in recognition of her achievements in science and her leading, inspirational role as a woman scientist, who puts innovation to the service of the developing world and promotes science education.

She graduated in pharmacology from King’s College London, in 1995, and five years later was the first woman from the Arab States of the Persian Gulf to obtain a PhD in biotechnology from the University of Cambridge, UK. Her entrepreneurial spirit brought her to file nine patents for a machine that uses the effects of light and ultrasound in the early detection of breast cancer.

In 2011, she launched “i2”—the Institute for Imagination and Ingenuity—that aims at empowering the next generation of innovators

through fellowships, training and mentorships. In 2018, she contributed to the launch of the “Engage” platform—the first digital hub of its kind for the developing world—aimed at accelerating economic and social progress in the developing world through science, technology and innovation.

Her Medal Lecture at TWAS Fifteenth General Conference was indeed focused on the power of biotechnology for the betterment of all people.

“As a scientist, I believe that through innovation, we can make a scientific impact and generate new solutions for education, health and livelihoods,” she said.

Then she offered a comprehensive overview of the most impacting achievements of biotechnology, which she pictured as “the science that uses natural cells and biomolecular processes.”

Humans have exploited for over 6,000 years biological processes carried out by microorganisms to prepare foods such as bread and cheese, and to preserve dairy products, she explained. But in this century, we are witnessing the unfolding of new, even more important biological secrets.

“Some important key inventions and discoveries are under our eyes: antiviral agents, gene editing techniques, how to grow in vitro artificial organs and even the hyperbaric therapy.”

Medical biotechnology is a powerful tool that enhances patients’ quality of life and alleviates suffering. In this respect, great

Read more:
www.twas.org/node/15249/

progress has been made in the field of artificial human organs: through biotech, we can create adequate conditions for cells to grow over scaffolds, to form organs that are immunologically safe and are not rejected by the recipient.

“At present, we can grow ears, but imagine what we could do if we could grow a human heart! For hearts, we are at a step where we clean the organ received from a donor using a detergent, to eliminate resident cells. Then, on the collagen skeleton that is left behind, we allow stem cells to rebuild the muscle.”

Sindi also explained the importance of hyperbaric therapy, which involves breathing pure oxygen in an environment under controlled pressure. This approach is mainly used to treat decompression sickness, a common risk for scuba divers. “Hyperbaric therapy reveals how little we know of the human body. Recent progress suggests it could be applied also in the case of Alzheimer, brain haemorrhages and even cancer. It’s a low-risk approach, which grants a good quality of life.”

Gene editing and the related molecular technologies have allowed leapfrog progress, in

recent years. Jennifer Doudna and Emmanuelle Charpentier were awarded the 2020 Nobel Prize in chemistry for developing a technology that allows cutting the DNA with molecular scissors, to rewrite the genetic code in case of disease-causing mistakes.

“They have opened an entirely new world, with potential applications to the treatment of major diseases, including cancer and inherited conditions, not only in developed but also in developing countries,” added Sindi, who led IsDB efforts in a joint initiative with the International Atomic Energy Agency, on saving women’s lives from breast and cervical cancer in low- and middle-income countries.

“The new mRNA technology that is playing an important role in the treatment of COVID-19 stems from these advances,” pointed out Sindi, who has been engaging with several health partners to develop solutions that strengthen the global supply of COVID-19 diagnostics by leveraging and building manufacturing capacity in IsDB member countries. Other common diseases, such as sickle cell anaemia, AIDS and malaria, may benefit from the application of gene editing techniques.

In parallel, she added, it is fair to mention that other COVID-19 treatments are in the pipeline, such as ivermectin, that granted the 2015 Nobel Prize in Physiology or Medicine to Satoshi Omura and William C. Campbell for their discovery of a novel therapy against infections caused by roundworm parasites.

As Sindi said: “This substance stops river blindness, and recently, in cell plates, it showed potential also against the coronavirus. Despite some controversies, as I speak, scientists are working to find analogues of ivermectin to stop COVID: at only 50 cents per treatment, this substance would be a remarkable tool in our fight against this virus.”

To conclude her speech, Sindi mentioned some pioneering researches aimed at extending human life up to the unprecedented age of 250 years, by rejuvenating cells that could, in principle, revitalize the entire body.

“This is biotechnology at its best,” Sindi said. “We can potentially target any disease, and give a better quality of life to people.”

▼ Hayat Sindi delivering her speech at TWAS Fifteenth General Conference, on 3 November 2021.

“I believe that through innovation, we can make a scientific impact and generate new solutions for education, health and livelihoods.” Hayat Sindi





SCIENCE NEEDS WOMEN

International organizations should propel gender equality in science, said TWAS Medal winner Roseanne Diab of South Africa at TWAS Fifteenth General Conference

 by Cristina Serra

Scientific policies and programmes can be more effective and sustainable when a ‘gender lens’ is applied. This is why international organizations should adopt gender-responsive policies, urged Roseanne Diab, an Emeritus Professor at the School of Environmental Sciences of the University of KwaZulu-Natal, in Durban, South Africa, at TWAS Fifteenth General Conference, held in an all-virtual mode from 1–4 November.

At the Conference—organized by the King Abdullah University of Science and Technology in collaboration with the Islamic Development Bank, both in Saudi Arabia—Diab was bestowed the prestigious TWAS Medal for her unceasing efforts to achieve a step-change towards gender transformation in science worldwide.

Diab is also a Special Advisor for GenderInSITE, an international initiative jointly run with UNESCO-TWAS, which aims to promote the role of women in science, innovation, technology and engineering, and to raise awareness amongst decision makers.

She is the former Executive Officer of the Academy of Science of South Africa and is recognized for her contributions in the field of atmospheric sciences, particularly air quality, climate change and tropospheric ozone variability. She was a Fulbright Senior Research Scholar and is a member of many international bodies. She currently chairs the Gender Advisory Committee, which was established to assist TWAS in promoting gender equality and equity in its membership, programming, grants and prizes, by providing recommendations of best practices.

Diab is now renowned internationally for advocating the importance of ‘gender responsiveness’ in organizations, referring

to outcomes that reflect an understanding of gender roles and inequalities, and through which efforts are made to encourage equal participation and equal and fair distribution of benefits. Such an approach is particularly needed in science.

In her Medal Lecture, Diab expressed her gratitude to TWAS for the enormous opportunity the Academy gave her through its prestigious recognition. And in her speech, she focused on “The Role of Gender-Responsive Organizations in Global Science,” explaining the concept and expanding on it. Being gender-responsive, she said, means creating an environment that promotes an inclusive approach, recognizing the needs of both women and men. There are still many unconscious biases that prevent building a workplace, where everybody is appreciated, respected and treated equally. Unfortunately,

A gender-responsive organization, she continued, may contribute enormously to science, a field in which many women scientists are active and productive. Gender responsiveness may eradicate the roots of inequality between women and men by addressing, inter alia, the unequal power relations between men and women.

“We tend to think that numerical gender parity is a good achievement in itself and that increasing the number of women fellows within institutes and academies is a valuable milestone,” Diab said in her presentation. She continued, “However, gender transformation involves far more than achieving gender parity. It is a shift from a focus on statistics to a deeper dimension that embraces an understanding of the needs and aspirations of all people, especially women.”

► Roseanne Diab during the 68th Lindau Nobel Laureate Meeting, in 2018. [Photo: Julia Nimke/Lindau Nobel Laureate Meetings]

She mentioned a report published on the GenderInSITE website in September of this year titled “Gender Equality in Science: Inclusion and Participation of Women in Global Science Organizations: Results of two global surveys”, which included data collected from 85 academies. The report revealed, for example,



“Gender transformation involves far more than achieving gender parity. It is a shift to a deeper dimension that embraces an understanding of the needs of all people.”

Roseanne Diab

that the mean share of women elected to membership of academies rose from 13 per cent, registered in a previous 2015 survey, to 17 per cent in 2020. On average, all academies experienced a moderate increase in women’s membership, but 19 of them still reported values of as little as 10 per cent female membership.

Addressing only the notion of parity in numbers is not enough. We need to take bolder steps, encouraged Diab. Institutions and academies worldwide should give more visibility

to women scientists. And she explained why three steps are necessary: “Women scientists should be given more decision-making power within the election committees because, at present, we see mostly men working in the ‘control room’. Women should also be given greater visibility as keynote speakers because the output of their research is no less significant than men’s and deserves to be profiled to a greater extent.” Finally, women should have greater control over resource allocation. This remark supports the notion of gender budgeting, which, according to the European Institute for Gender Equality, means a gender-based assessment of budgets, incorporating a gender perspective at all levels of the budgetary process. In the absence of gender budgeting, gender inequalities will persist.

Gender equality is an investment, remarked Diab. Studies show a link between greater gender equality and increased growth and employment. In addition, evidence confirms that improvements in gender equality would generate up to 10.5 million additional jobs by 2050, and that the European Union employment rate would reach almost 80 per cent.

But too few scientific institutions invest in gender equality. From the survey she mentioned earlier, Diab revealed how only 30 out of 84 academies have a policy that explicitly mentions the need to increase women’s membership, and more than 60 per cent of the academies have no formal plan in place.


Concluding with a comment on UNESCO-TWAS, Diab noted that “TWAS has great potential to play a powerful gender-transformative role and to influence norms and practices in science academies across the developing world. TWAS draws its fellows, prize winners and attendees at events from multiple countries, and also has five regional partners through which it can play an influential role.” And finally, she said, “Achieving gender transformation requires the engagement of both men and women. It’s not only a men’s or women’s responsibility: we can travel this journey together.” In fact, we can only travel this journey together. ■

Read more:
www.twas.org/node/15246/



SEEING THROUGH AN INSECT'S EYES

TWAS Fellow and Medal Lecturer Mandyam Srinivasan bridges biology and robotics through research on how bees perceive and navigate through their environments

 by Sean Treacy

To a bee, the world looks very different. Their large segmented eyes give them a panoramic view of their environment. But they're also closer together, so they have more difficulty triangulating the distance of objects the way humans do.

So, they need to come up with other ways to judge the proximity of objects in order to perform precise flight manoeuvres as they go about their lives. And, as it turns out, these methods are useful for flying robots, as they too must automatically react to the world around them.

This is the subject of research by TWAS Fellow and 2021 Medal Lecturer Mandyam Srinivasan, Emeritus Professor of Visual and Sensor Neuroscience at the University of Queensland in St. Lucia, Australia. Based on his accomplishments in this field, he was awarded a TWAS Medal and invited to deliver the relevant Medal Lecture on 3 November, during the Academy's Fifteenth General Conference. TWAS Medal Lectures were established in 1996, and the Conference typically features two or three leading scholars and Medal winners, who are invited to present their work.

Srinivasan called the award an unexpected surprise. "I don't even know who nominated me," he said, "I'm humbled and delighted."

In his presentation "Small Brains, Smart Minds: From Bees and Birds to UAVs" Srinivasan discussed visual tricks that small flying creatures have evolved to navigate their environments, and how this information is useful in the interdisciplinary field of biorobotics.

Honeybees are some of nature's most

impressive navigators. After a worker bee finds a source of food, she will return to her hive and perform a dance that conveys detailed information about the source of the food and where to find it. Then the other bees will know exactly where to go. "All this behaviour is being orchestrated by a brain that weighs less than a milligram, and carries far fewer neurons than our own brains," said Srinivasan. "So, one of the missions of our lab is to find out what makes these wonderful creatures tick, and tick so well."

The distance between their eyes is also very small, which means they don't have very good depth perception—at least, in the sense that humans might understand it. Human beings can determine how far an object is by triangulating with both their eyes, but bees need to be in motion themselves, to understand how far away something is. They can do this because objects that are close by appear to move more quickly than objects that are far away, and their tiny bee brains are capable of calculating distance based on this speed-of-motion.

Srinivasan and his colleagues tested and proved this theory through a serendipitous observation: bees sometimes flew into their lab through a hole in the wall—perfectly, right down the middle. They created an experiment with a tunnel for bees to fly through. Both walls of the tunnel carried vertical stripes. When the walls were stationary, the bees flew precisely down the middle of the tunnel. However, when one wall was moved against the bee's flight direction, it created an illusion of being closer, causing the bee to veer away from the wall. But



▲ TWAS Medal Lecturer Mandyam Srinivasan [Photo provided]

► TWAS Medal Lecturer Mandyam Srinivasan, right, discussing his research at a question-and-answer session moderated by TWAS Vice-President for the Arab Region Sabah AlMomin, left, during TWAS Fifteenth General Conference, on 3 November 2021.



when the wall was moved in the same direction, it appeared to be farther away, causing the bee to veer toward it. This demonstrated that bees navigate narrow passages safely by balancing the speeds of motion they visually sense.

“One of the missions of our lab is to find out what makes these wonderful creatures tick, and tick so well.” *Mandyam Srinivasan*

Srinivasan and his colleagues were able to further refine their findings by placing food at the end of the striped tunnels, and later observing what each worker bee communicated to her hive mates using the language of dance. The longer the bees waggle in their ‘dance’, for example, the further the distance of the food. And the bees gauge this distance by measuring the total amount of image motion that they have experienced on the journey from the nest to the food source.

“It turns out that the bee dance is a wonderful window into the bee’s mind, because it allows us to tap into the bee’s perception of how far it thinks it has travelled under various experimental conditions that we set up in the lab,” said Srinivasan.

Further research from Srinivasan and his team also involved research on the flying skills of common parakeets. They found, for example, that parakeets are able to tell if a gap they have to fly through is smaller than their wingspan, forcing them to tuck their wings in mid-flight to get through safely. They also repeated the bee experiment with stripes on the walls of a corridor, only with parakeets this time, and demonstrated that the birds also used the image motion to determine object distance while flying.

The research on bee and bird vision has novel applications for automation. An insect is completely self-reliant, meaning that it doesn’t rely on external communication, exactly like global positioning systems (GPS) derived from satellites, or radar, and many modern robotics systems do. So, potentially, a flying robot with visual capabilities could use a bee’s motion-to-distance calculations to navigate its environment without any external help.

During TWAS General Conference, Srinivasan presented a video of such a robot, successfully taking off, cruising for a while, turning around and landing again, using only visual cues from the motion of objects in its environment, navigating much like a bee does. Applications exist for the developing world, as well, he noted. In parts of the world where GPSs are likely to be unavailable, robots need internal guidance systems that are cheap and lightweight and can navigate on their own. ■

Read more:
www.twas.org/node/15248/



◀ Clockwise (from top left): Symposium convener and TWAS Fellow George Gao of China, TWAS Fellow Salim Abdool Karim of South Africa, TWAS Fellow Firdausi Qadri of Bangladesh, TWAS Fellow Cesar Victora of Brazil, Lianpan Dai of China, and TWAS Fellow Peter Singer of Canada.

per cent more with one dose, adding that “COVID-19 anywhere is COVID-19 everywhere.”

Peter Singer of Canada, Special Advisor to the Director-General of the World Health Organization and also a 2009 TWAS Fellow, noted the importance of expanding global manufacturing capacity so as to strengthen an equitable access to vaccines. Lara Manganaro, of the National Institute of Molecular Genetics in Italy, discussed her research investigating the effectiveness of the mRNA vaccine in people living with HIV.

TWAS Fellow Cesar Victora, Emeritus Professor of epidemiology at the Federal University of Pelotas, Brazil, detailed the impact of misinformation and fake news on the spread of COVID-19 in his country. “My question for discussion here is, what else can scientists do?” he asked. “Can we get into the more serious business of contradicting fake news, and disseminating scientific knowledge through social media and other channels?”

While speakers did not shy away from being realistic about the big challenges the pandemic poses, they also shared sustainable solutions and success stories. It took, for example, only nine months for the first vaccine to be tested and put on the market. And now there are more than a dozen vaccines available. Ad maiora. ◼

[Read more: www.twas.org/node/15256/](http://www.twas.org/node/15256/)

THE WORLD FACING COVID-19

✍ by Sean Treacy

Panel of epidemiologists, immunologists and policy advisors at TWAS Fifteenth General Conference explores the importance of equity to maintain global health

The two years since the COVID-19 pandemic began have challenged the world in an unprecedented way, but they have also been a period of important lessons. These lessons have been both scientific and social, said eminent figures at TWAS Fifteenth General Conference symposium held on 3 November, revealing inequities and serving as a reminder of the dangers of misinformation and the importance of global cooperation.

The symposium, titled “The world facing COVID-19”, featured a series of talks that presented a strong case for

a more just world, where everyone had access to needed vaccines.

Speaker and TWAS Fellow Salim Abdool Karim, Director of the Centre for the AIDS Programme of Research in South Africa [CAPRISA] in Durban, South Africa, said the virus had set the world back in its mission to meet the United Nations Global Goals. The virus, he said, is not just an infection, but an event that has had major global impacts across many issues, with 150 million more people in poverty than when the pandemic began. COVID-19 also highlighted disparities, he said. “They have become far wider than we had ever anticipated, whether they are disparities on race or gender, or in access to resources like data or vaccines.”

According to Firdausi Qadri, a TWAS Fellow and Immunologist at the International Centre for Diarrhoeal Disease Research in Dhaka, Bangladesh, her country has inoculated only 10 per cent of the population with two doses of the vaccine, and 14

THE INTERNATIONAL TWAS FAMILY GROWS

With the election of 58 new Fellows at the Academy's Fifteenth General Conference, TWAS membership reaches 1,343

Every year, talented scientists from all over the world are elected to become lifelong TWAS Fellows. Their distinctive feature is scientific excellence, as they all display a track record of relevant contributions to the advancement of science.

The procedure to become TWAS Fellows is the following: TWAS Fellows already in office put forward the names of eligible scientists. Such propositions are evaluated by TWAS Membership Advisory Committees. TWAS Council then reviews the recommended candidates, and TWAS Fellows present at the following TWAS General Meeting—the segment of TWAS General Conference devoted to internal matters—vote on the nominees.

At TWAS Fifteenth General Conference, held from 1–4 November, 58 new TWAS Fellows were elected, of whom 20 are women (one third of the new Fellows), 13 are from countries non-represented or underrepresented in TWAS membership, and 10 of those are from the global South.

NEW TWAS FELLOWS

01 Agricultural Sciences

- EGAMBERDIEVA, Dilfuza of Uzbekistan [F], Head of Ecobiome Research Centre, National University of Uzbekistan
- EMAM-DJOMEH, Zahra of the Islamic Republic of Iran [F], Full Professor, University of Tehran, Islamic Republic of Iran
- ISLAM, Md Tofazzal of Bangladesh [M], Professor and Director, Institute of

Biotechnology and Genetic Engineering, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur, Bangladesh

02 Structural, Cell and Molecular Biology

- GUILLEN, Gerardo of Cuba [M], Director of Biomedical Research, Centre for Genetic Engineering and Biotechnology, Havana, Cuba
- PANDA, Dulal of India [M], Professor, Indian Institute of Technology Bombay, India
- SAAD, Bashar of Palestine [M], Head of Biochemistry Unit, Arab American University Palestine, Jenin, West Bank, Palestine
- TEIXEIRA, Santuza of Brazil [F], Full Professor, Department of Biochemistry and Immunology, Federal University of Minas Gerais, Belo Horizonte, Brazil

03 Biological Systems and Organisms

- DUBE, Anuradha of India [F], Chief Scientist, Division of Parasitology, Central Drug Research Institute, Lucknow, India
- HILDEBRAND, John of the United States of America [M], Regents Professor of Neuroscience, University of Arizona, United States of America
- JHA, Pramod Kumar of Nepal [M], Professor-Emeritus, Tribhuvan University, Nepal
- MBACHAM, Fon Wilfred of Cameroon [M], Titular Professor of Public Health Biotechnology, University of Yaoundé I, Cameroon
- MEKONNEN, Yalemtehay of Ethiopia [F], Professor of Cell and Human Physiology, College of Natural and Computational Sciences, Addis Ababa University, Ethiopia



- ORYAN, Ahmad of the Islamic Republic of Iran [M], Professor, Pathology Department of Shiraz University, Shiraz; and Vice-Chancellor of Yasouj University, Yasuj, both in the Islamic Republic of Iran
- RADA TARIFA, Ana of Bolivia [F], Cytogenetics Unit, Genetics Institute, Faculty of Medicine, Universidad Mayor de San Andrés, La Paz, Bolivia
- SADUNISHVILI, Tinatin of Georgia [F], Academic Secretary, Biological Department, Georgian National Academy of Sciences; and Professor and Head of Department, Agricultural University of Georgia, both in Tbilisi, Georgia
- VAL, Adalberto Luis of Brazil [M], Senior Researcher, National Institute for Amazonian Research, Brazil

04 Medical and Health Sciences, including Neurosciences

- CHATTERJEE, Mitali of India [F], Professor and Head, Department of Pharmacology, Institute of Postgraduate Medical Education and Research, Kolkata, India
- CHEN, Zi-Jiang of China [F], Chief Scientist and Director, Centre for Reproductive Medicine, Shandong University, Jinan, China
- CROMBET RAMOS, Tania of Cuba [F], Clinical Research Director, Centre of Molecular Immunology, Cuba
- GAYE, Oumar of Senegal [M], Director, University Cheikh Anta Diop, Senegal
- GLUCKMAN, Peter David of New Zealand [M], Director, Koi Tū: The Centre for Informed Futures, Auckland, New Zealand
- HUNGRIA DA CUNHA, Mariangela of Brazil [F] Researcher, Brazilian Agricultural Research Corporation [Embrapa] Soybean, Londrina, Brazil
- JAYE, Assan of Gambia [M], Head of Research Training and Career Development, Medical Research Unit The Gambia, London School of Hygiene and Tropical Medicine, Serrekunda, Gambia
- KWOK, Pui-Yan of Taiwan, China [M], Distinguished Research Fellow and Director [Academician], Institute of Biomedical Sciences, Academia Sinica, Taiwan, China
- NG, Kwan Hoong of Malaysia [M], Professor, Department of Biomedical Imaging, University of Malaya, Kuala Lumpur, Malaysia

- NTOUMI, Francine of the Republic of the Congo [F], Chief Executive Officer, Fondation Congolaise pour la Recherche Médicale, Brazzaville, Republic of the Congo
- ZUMLA, Alimuddin of the United Kingdom [M], Professor of Infectious Diseases and International Health, Royal Free Hospital, London, United Kingdom

05 Chemical Sciences

- BADSHAH, Amin of Pakistan [M], Tenured Professor and Dean, Department of Chemistry, Quaid-i-Azam University, Islamabad, Pakistan
- BHARGAVA, Suresh Kumar of Australia [M], Deputy Pro-Vice Chancellor, College of Science, Engineering and Health, Royal Melbourne Institute of Technology, Melbourne, Australia
- CHERGUI, Majed of Switzerland [M], Professor, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland
- GOULART, Marilia Oliveira Fonseca of Brazil [F], Full Professor, Institute of Chemistry and Biotechnology, Federal University of Alagoas, Maceió, Brazil
- WU, Li-Zhu of China [F], Professor, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, China

06 Engineering Sciences

- ALOUINI, Mohamed-Slim of Saudi Arabia [M], Distinguished Professor of Electrical and Computer Engineering, King Abdullah University of Science and Technology, Jeddah, Saudi Arabia

▼ TWAS President
Mohamed Hassan
presenting candidates for
TWAS membership during
TWAS General Meeting,
on 1 November 2021.



- DEZOTTI, Márcia Walquíria De Carvalho of Brazil [F], Full Professor, Federal University of Rio de Janeiro, Brazil
- LUO, Jianbin of China [M], Chair, Asian Tribology Council, Tsinghua University, Beijing, China
- MITRA, Sushmita of India [F], Professor, Machine Intelligence Unit, Indian Statistical Institute, Kolkata, India
- SOBOYEJO, Winston Oluwole of the United States of America [M], Senior Vice-President and Provost, Worcester Polytechnic Institute, Worcester, United States of America
- TAO, Dacheng of Australia [M], Australian Laureate Fellow, Chair, The Peter Nicol Russell Undergraduate Scholarship; Professor of Computer Science, The University of Sydney, Australia
- WAN DAUD, Wan Ramli of Malaysia [M], Chair Professor of Sustainable Hydrogen Energy, Universiti Kebangsaan Malaysia, Bangi, Malaysia

07 Astronomy, Space and Earth Sciences

- AHMED, Shakeel of India, [M], Chair Professor, Department of Geography, Jamia Millia Islamia, New Delhi, India
- OCHIENG OLAGO, Daniel of Kenya [M], Associate Professor, University of Nairobi, Nairobi, Kenya
- SOKONA, Youba of Mali [M], Vice-Chair, Intergovernmental Panel on Climate Change, c/o the World Meteorological Organization, Geneva, Switzerland
- YU, Gui-Rui of China [M], Deputy Director, Scientific Committee, European Organization for Nuclear Research [CERN], Meyrin, Switzerland; and Director, Synthesis Research Centre, National Ecosystem Research Network of China

08 Mathematical Sciences

- ATANGANA, Abdon of South Africa [M], Full Professor, Institute for Groundwater Studies, University of the Free State, Bloemfontein, South Africa
- MUKHAMEDOV, Farrukh of the United Arab Emirates, [M], Professor, Department of Mathematical Sciences, College of Science, United Arab Emirates University, Abu Dhabi United Arab Emirates

- OMIROV, Bakhrom of Uzbekistan [M], Professor, Head, Algebra and Functional Analysis Department, National University of Uzbekistan, Tashkent, Uzbekistan
- OUHABAZ, El Maati of France [M], Professor, Université Bordeaux 1, Institut de Mathématiques de Bordeaux, Bordeaux, France
- WANG, Xiaoyun of China [F], Professor, Institute of Advanced Study, Tsinghua University, Beijing, China

09 Physics

- ALTSHULER, Ernesto of Cuba [M], Full-Titular Professor, Physics Faculty, University of Havana, Havana, Cuba
- DABHOLKAR, Atish of India [M], Director, The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy; and Assistant-Director General of UNESCO, Paris, France
- JÓRIO, Ado of Brazil, [M], Full Professor, Universidade Federal de Minas Gerais, Belo Horizonte, Brazil
- LI, Ruxin of China [M], Director and Professor, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, Beijing, China
- MAHADEVAN, Priya of India, [F], Senior Professor, S.N. Bose National Centre for Basic Sciences, Kolkata, India
- NAQIB, Saleh Hasan of Bangladesh [M], Professor, Department of Physics, University of Rajshahi, Rajshahi, Bangladesh

10 Social and Economic Sciences

- JAKOVLJEVIC, Mihajlo [Michael] of Serbia [M], Full-time Professor and Head of Department of Global Health Economics and Policy, University of Kragujevac, Kragujevac, Serbia
- LIMA, Nisia Trindade of Brazil [F], President and Senior Public Health Researcher, Oswaldo Cruz Foundation [Fiocruz], Rio de Janeiro, Brazil
- SETATI-PHAKENG, Mamokgethi of South Africa [F], Vice-Chancellor, University of Cape Town, Cape Town, South Africa
- VON BRAUN, Joachim of Germany [M], Director, Centre for Development Research and Professor, Economics and Technical Change, University of Bonn, Bonn, Germany



PEOPLE, PLACES & EVENTS

NEW TWAS COUNCIL MEMBER

Sandra Díaz, a Professor of community and ecosystems ecology at the National University of Córdoba, Argentina, and a TWAS Fellow since 2010, was named TWAS Council Member for Latin America and the Caribbean (2019–2022). The Council comprises 15 members and makes decisions on all matters affecting the Academy, including programmes, finances and newly elected members.



Díaz is also a Senior Principal Researcher at the National Scientific and Technical Research Council of Argentina, and an expert in the interaction between plants and environmental change drivers, and on the links between biodiversity and people. In 1989, she earned a PhD in biological sciences from the National University of Córdoba. She has been Co-Chair of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and one of the main authors of first Global Assessment Report on Biodiversity and Ecosystem Services, adopted in 2019.

2021 G. WEBER AWARD TO TWAS FELLOW

Francisco J. Barrantes, Director of the Laboratory of Molecular Neurobiology at the Pontificia Universidad Católica Argentina-CONICET in Buenos Aires and a TWAS Fellow since 1991, received the 2021 Gregorio Weber Award for Excellence in Fluorescence Theory and Applications.



The prize is named after Prof. Gregorio Weber, a pioneer who developed the theory and application of fluorescence techniques in biology and biochemistry. Barrantes, with a PhD from the University of Buenos Aires (1973), spent the early years of his career at the Max-Planck Institute for Biophysical Chemistry, in Göttingen, Germany. He was a visiting professor at universities in the US, Israel, Spain and the UK. In Argentina, he introduced the patch-clamp technique to study ionic currents in individual isolated living cells.

2021 BLUE PLANET PRIZE TO TWAS FELLOW

Mohan Munasinghe, Chair of the Munasinghe Institute for Development of Sri Lanka (MIND) and of the MIND Group, and a TWAS Fellow since 1994, won the 2021 Blue Planet Prize, considered the equivalent of the Nobel Prize for the environment. The prize, sponsored by Japan's Asahi Glass Foundation, honours individuals who develop innovative environmental solutions. Munasinghe was Chair of the Presidential Expert Commission of Sustainable Sri Lanka 2030 Vision, Senior Energy Advisor to the President of Sri Lanka, and Vice-Chair of the Intergovernmental Panel on Climate Change (IPCC), which shared the 2007 Nobel Peace Prize with US former Vice-President Al Gore. At the 1992 Rio Earth Summit, he pioneered "sustainomics" an integrated, transdisciplinary and practical framework for making development more sustainable.



2022 L'ORÉAL-UNESCO AWARD TO TWAS FELLOW

Agnès Binagwaho, a Professor of Pediatrics, the Vice-Chancellor of the University of Global Health Equity, in Kigali, Rwanda, and a 2021 TWAS Fellow, is the winner for Africa and the Arab States region of the 24th edition of the L'Oréal-UNESCO For Women in Science International Awards in the field of life sciences.



Every year since 1998, the Awards honour exceptional women scientists from the five major regions of the world, their exceptional achievements and uniqueness. Binagwaho was selected among 358 candidates "for her critical role in establishing, advocating for, and creating a new model of equitable public health care for the most vulnerable in Rwanda, Africa, and the world".

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The World Academy of Sciences for the advancement of science in developing countries (UNESCO-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 laureate. Today, UNESCO-TWAS has more than 1,300 elected Fellows representing 108 countries; 11 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, namely to:

- 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 and
- Encourage scientific and engineering research and sharing of experiences in solving major problems facing developing countries.

TWAS and its partners offer 260 fellowships per year to scientists of the developing world for PhD studies and postdoctoral research. TWAS awards are among the most prestigious given for scientific work in the developing world. The Academy distributes nearly \$1 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.

UNESCO-TWAS hosts and works in association with two organizations, also hosted on the ICTP campus: the **Organization for Women in Science for the Developing World (OWSD)** and the **InterAcademy Partnership (IAP)**.

At its founding in 1989, OWSD was the first international forum uniting women scientists from the developing and developed worlds. Today, the Organization has more than 6,500 members. Their objective is to strengthen the role of women in the development process and promote their representation in scientific and technological leadership.

IAP represents more than 140 national and regional science and medical academies worldwide. It 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.

TWAS, a programme unit of UNESCO, receives its core funding from the Italian Ministry of Foreign Affairs and International Cooperation.

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