Year 2022 - Vol. 34 - No. 2-4

United Nations Educational, Scientific and Cultural Organization

twas

NEWSLETTER

A PUBLICATION OF THE WORLD ACADEMY OF SCIENCES

Gatherings for science

In-person meetings begin again as pandemic restrictions thaw

Science diplomacy – a bridge to the future

To solve regional and global challenges, the world needs partnerships between scientists, policymakers and diplomats. They come together at **TWAS workshops and courses**.

Photo: Tartarin2009/flickr

www.twas.org/science-diplomacy

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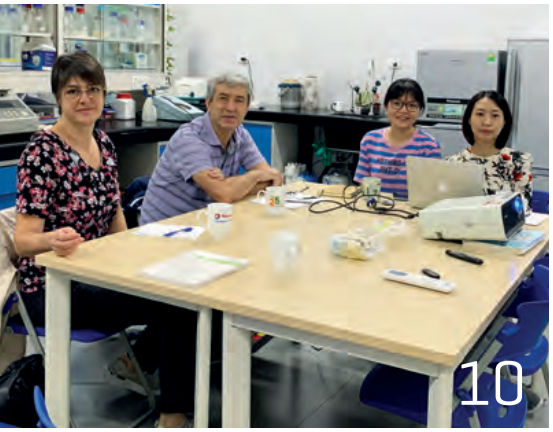

▲ Top: Participants in the Ernesto Illy Colloquia engage in vibrant discussions during breakout groups. (Photo: Paola Di Bella/TWAS) Above: ICGEB microbiologist Vittorio Venturi with some members of his team. (Photo: ICGEB)

Cover picture: A participant in the Ernesto Illy Colloquia on coffee industry sustainability, hosted by TWAS in Trieste, Italy, asks a question. (Photo: Paola Di Bella/TWAS)

▼ Anton Zeilinger, former President of the Austrian Academy of Sciences, at the opening ceremony of the 13th General Conference and 26th General Meeting in Vienna, Austria, on 18 November 2015. (Photo: Michael Weinwurm/ ÖAW-TWAS)

EDITORIAL

SCIENCE BRINGS PEOPLE TOGETHER

▲ TWAS President Mohamed H.A. Hassan

The SARS-CoV-2 virus is still among us, but thanks to the quick development of safe and effective vaccines, countries around the world are easing COVID-19 restrictions. I am proud to acknowledge that TWAS stands strong amid the pandemic and has been able to adapt to the many challenges posed by the COVID-19 crisis.

Thanks to this progress, we have also started organizing in-person or hybrid events again, and this newsletter is a testament to that. Sitting in the same room, sharing meals, or talking over a cup of hot coffee between conference sessions allow for more fluid conversation and encourage brainstorming. As a result, life-long friendships and fruitful professional collaborations are formed.

The Ernesto Illy Colloquia was our first event with a significant in-person component since the pandemic began. Through this event, young scientists conducting coffee-related research in the global South were able to connect with experts in the field and form connections with each other that could foster lengthy research collaborations.

Science and scientists do not live in a vacuum. Now, more than ever, the general public, including the younger generations, should have the chance to get in touch with scientific ideas, evidence-based suggestions, and rational thinking. Outreach events as the international science festival Trieste Next are instrumental for engaging with the wider society, and can ignite the spark of curiosity in children, hopefully helping them to pursue careers in science.

Although the benefits of in-person meetings are clear, we should not forget the benefits of hybrid and online events. The climate crisis is one, if not the most, serious threat to our families, friends, and countries—and the carbon footprint of international travel cannot be underestimated.

Attending an in-person event often means staying away from home for days at a time. But while travelling for a few days can be a great opportunity for personal and professional growth, this is a luxury that those of us who must care for elderly parents, sick relatives, children, or other people, cannot always enjoy. This is why we should make the most of what we have learned during the pandemic about online events and make sure our initiatives are as inclusive as possible.

While governments are lifting COVID-19 restrictions and many of us have returned to doing some, if not most, of our pre-pandemic activities, we should be careful not to forget the long-lasting impact the crisis had on us all, as well as how it exacerbated inequalities.

To beat the virus, we must follow the advice given by health experts, and make sure that whenever we gather together we do so in a way that is safe for ourselves and our communities. But I hope the stories told in this Newsletter also help us rediscover the beauty and power of our events, and the in-person, human connection they provide.

Mohamed H.A. Hassan
TWAS President

TWAS NEWSLETTER
Published quarterly by The World Academy of Sciences for the advancement of science in developing countries.

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IN THE NEWS

Conference takes aim at 'helicopter research'

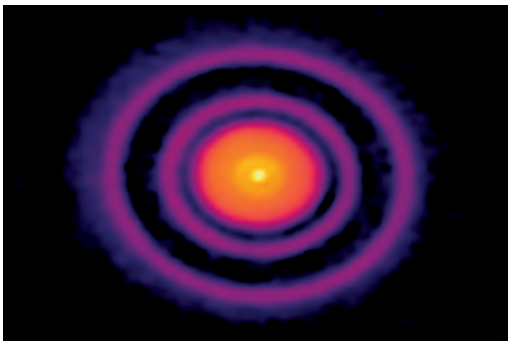
When researchers from wealthy countries engage in "helicopter research"—thoughtless field research in poorer countries that extracts data without respectful collaboration—they violate research integrity and pose a moral problem, said attendees at the World Conference on Research Integrity, held in Cape Town, South Africa, in May–June 2022.
The conference saw the launch of the "Cape Town Statement" on equitable research partnerships.

Source: Science

Astronomers find glowing gas around a baby planet

In recent years, radio telescopes like the Atacama Large Millimeter/submillimeter Array in Chile have captured images of glowing disks of material around young stars. Rarely, they observe a faint glowing disk of material swirling around a forming planet itself, from which moons might begin to accrete, called circumplanetary disks (CPDs).
Only two CPDs have ever been observed, but now astronomers have found what may be a third—and for the first time, they think they have detected the much fainter emission from gas in the disk.

Source: Astronomy Magazine



▲ Image: ALMA (ESO/NAOJ/NRAO), A. Sierra (U. Chile)

Asia's coastal cities 'sinking faster than sea level-rise'

Manila and several other coastal Asian cities are sinking faster than the rate of sea level rise, says a study that calls for strict regulatory measures to reduce groundwater extraction.
Manila's land was subsiding by more than 2 centimetres per year between 2015 and 2020, almost seven times faster than the average sea level rise. The phenomenon of land sinking faster than sea level rise is more pronounced in Asian cities than elsewhere, says the study published in April in *Geophysical Research Letters*.

Source: SciDev.Net

Clues emerge on COVID-19 and smell loss

Researchers are finally making headway in understanding how the SARS-CoV-2 coronavirus causes loss of smell.
A study published in May 2022 surveyed 616,318 people in the United States who have had COVID-19. It found that, compared with those infected with the original virus, people who had contracted the Alpha variant were 50% as likely to have chemosensory disruption. This probability fell to 44% for the Delta variant, and to 17% for the latest variant, Omicron.

Source: Nature News

A new origin story for domesticated chickens

Researchers have debated where and when chickens originated for more than 50 years. Now, in two new studies, scientists lay out a potential story of the chicken's origins.
This tale begins in rice fields planted by Southeast Asian farmers around 3,500 years ago, zooarchaeologist Joris Peters and colleagues report. From there, the birds were transported westward not as food but as exotic or culturally revered creatures, the team suggests in the *Proceedings of the National Academy of Sciences*.

Source: Science News

ERNESTO ILLY COLLOQUIA

WAKING UP TO COFFEE SCIENCE

A farmer inspecting a fully matured coffee plant at a farm in Nakaseke, Uganda. (13 October 2016) [Photo: Food and Agriculture Organization of the United Nations]

TWAS and the Ernesto Illy Foundation partnered to establish Colloquia designed to analyse how to make coffee production sustainable, and the event was rich with promise for a better future

by **Sean Treacy** and **Raffaella De Lia**

Coffee isn't just a favourite drink for early risers. It's also a significant commodity, and an important part of the world economy—especially in the global South, where a large majority of coffee crops are grown. And as climate change threatens agricultural practices that the coffee business has come to rely on, a critical question emerges: How can we ensure that the world's coffee production is sustainable?

With this enormous challenge in mind, TWAS and the Ernesto Illy Foundation co-organized "Ernesto Illy Colloquia: Sustainability challenges in coffee-growing worldwide", a first-of-its-kind event. Taking place from 27–29 September 2022, the Colloquia featured experts in coffee science and economics, using a hybrid format combining an international online audience with in-person attendance at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

The Colloquia sought to link young scientists with sustainability experts, advance coffee research, and develop collaborations that support coffee cultivation. Participants to the event included 20 scientists in coffee research, selected by TWAS, and 22 students attending the Ernesto Illy Foundation's Master Degree in Economics and Science of Coffee—a unique first-level course that combines online teaching with a month-long residency and in-person lessons in Trieste.

Participants of both groups came mainly from least developed countries. Topics for discussion were the sustainability challenges in agriculture and coffee-growing, biodiversity breeding and genetics, regenerative agriculture, and the need for greater scientific capacity in developing countries to research coffee agriculture, among others.

"Through this event, the Foundation wants to remember and fulfil Ernesto Illy's legacy, pioneering sustainability ideas and practice," said Furio Suggi Liverani, Director of the Ernesto Illy Foundation. "The Fondazione Ernesto Illy has always been recognized in Trieste's scientific landscape, by cooperating with private and public institutions, including TWAS. The aim of the Colloquia is to create a network for scientific cooperation, to support multidisciplinary research on the future of coffee-growing and regenerative agriculture practices in general, in particular for mitigating the effects of climate change and promoting sustainable economic, social and environmental development."

"This event represents a fantastic opportunity not only for the coffee sector but for coffee-growing countries throughout the global South," said TWAS Executive Director Romain Murenzi. "We are most pleased to partner with the Ernesto Illy Foundation on these Colloquia. And we believe that the insights and research links that will emerge from this event will greatly help in our efforts to ensure sustainable coffee production and economic growth for developing countries."

Speakers included high-level figures in science, policy and sustainability, such as world-renowned sustainability expert and Director of the Center for Sustainable Development at Columbia University in the United States Jeffrey Sachs; TWAS Fellow, soil scientist and Director of Carbon Management and Sequestration Center at Ohio State University Rattan Lal; and illycaffè Chair Andrea Illy. Also among the presenters were Scientific Coordinator for the Trieste-based International Centre for Genetic Engineering and Biotechnology Vittorio Venturi; and Senior Researcher at the ICTP Earth System

◀ illycaffè Chair Andrea Illy [Photo: TWAS]

Physics section Erika Coppola. Attendees also participated in an activity with break-out groups designed to facilitate the learning experience and help establish new research connections.

A SUCCESSFUL OPENING

The idea for a project between TWAS and the Ernesto Illy Foundation originally emerged in 2019, with plans to hold the Colloquia in 2020. But these plans were delayed until 2022 due to the COVID-19 pandemic. As pandemic restrictions relaxed, it finally became a reality years later, on 27 September 2022.

While the concerted commitment of the Ernesto Illy Foundation and TWAS to hold these Colloquia was in line with similar global projects, it was also a 'niche effort', enabling the organizing institutions to honour the mission of TWAS to build capacity in developing countries, while also honouring the Academy's home city of Trieste. Trieste is commonly considered Italy's unofficial 'coffee capital', and is the centre of the Illy Foundation and its enterprise.

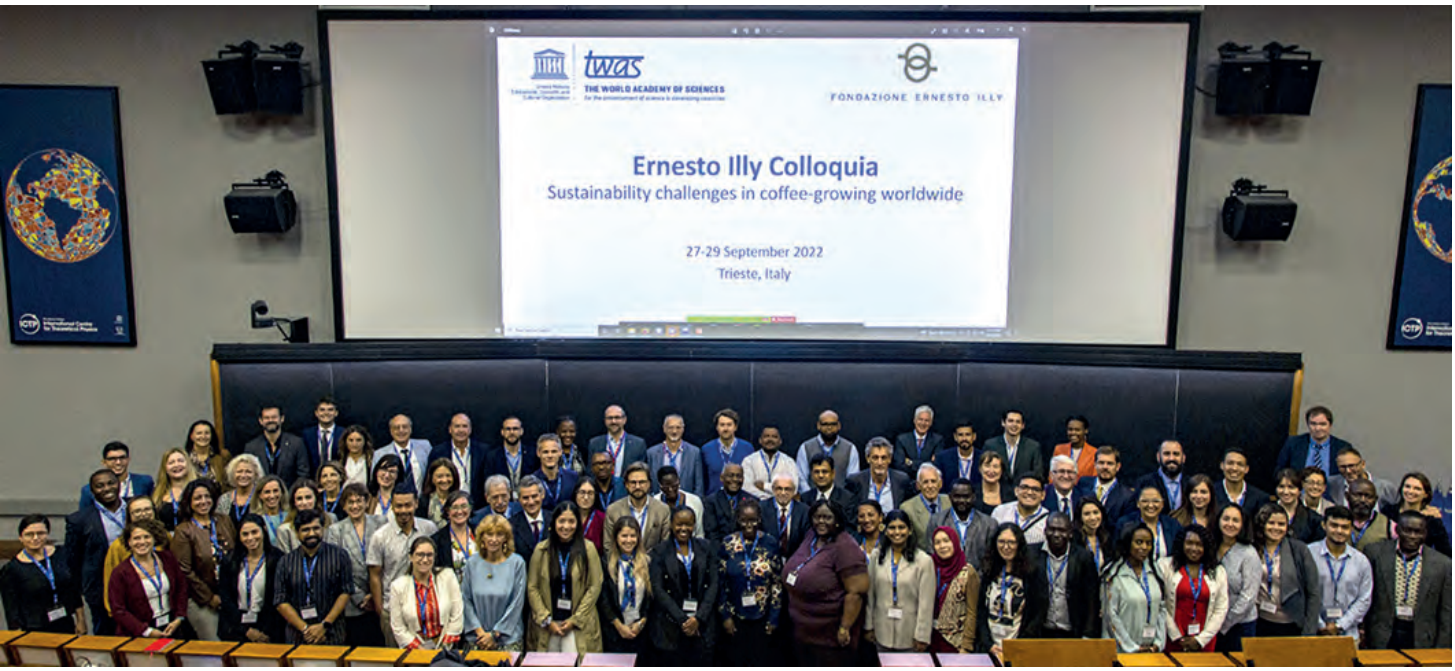
Furio Suggi Liverani, Chief Scientific Officer of illycaffè and Director of the Ernesto Illy Foundation, officially presented the Colloquia and paid homage to the 'Triestino' chemist and entrepreneur after whom the event was named. Suggi Liverani recalled the mutual admiration that Ernesto Illy and Paolo Budinich—a TWAS founder—had for each other, and the trust in science the two shared.

He also explained the choice of defining the event as "colloquia", as Ernesto Illy himself would have wanted it: not a conference, but a place to initiate a debate, to get to know other coffee-industry players around the world, and a place of interdisciplinarity, ideas and true innovation. Ernesto Illy would have appreciated the pooling of eminent scientists and researchers that resulted in the Colloquia, he said.

In his keynote intervention, Zitouni Ould-Dada, the Deputy Director of the Climate and Environment Division of the Food and Agricultural Organization of the United Nations, set the scene for the sessions to come. He described the transformation of agri-food systems in light of the current challenges, including the COVID-19 pandemic, and the short time remaining to implement the United Nations Sustainable Development Goals.

The first scientific session of the day started with Erika Coppola, Senior Researcher at the ICTP Earth System Physics section. An expert in climate—extremes, variability and change—Coppola was one of the lead authors of the Working Group I contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), released in August 2021. In her intervention on 'Climate

▼ Sitting speakers during an Ernesto Illy Colloquia session, from left: Serena Tonel, Deputy Mayor of Trieste, also in charge of Economic Policy; Alessia Rosolen, Regional Councillor for Work, Training, Education, Research, University and Family; Furio Suggi Liverani, Chief Scientific Officer of illycaffè, Director of Ernesto Illy Foundation; Romain Murenzi, TWAS Executive Director; Atish Dabholkar (speaking), Director of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. Standing at the podium is TWAS Editor Raffaella De Lia. [Photo: Paola Di Bella/TWAS]



▲ Participants, speakers and organizers of the Ernesto Illy Colloquia at the end of the opening ceremony of the Colloquia in the Budinich Hall of the International Centre for Theoretical Physics (ICTP) on 27 September 2022 (Photo: Paola Di Bella/ TWAS)

> The differences in profitability of farming in a region depends on how much farmers have access to these important resources.
>
> *Christoph Sänger, Head of Competiveness in the Policy, Strategy and Delivery Department of the European Bank for Reconstruction and Development, on the availability of finance, certification, and markets*

Change and its Effects on Agriculture', she shared the latest update on climate research science and warned that "every small increase in warming will result in an increase in risk."

Geneticist Benoît Bertrand, Research Director of the French Agricultural Research Centre for International Development, delivered his presentation on 'Sustainability Challenges in Agriculture and Coffee-growing'. The global context was worrying, he said, underlining a simple but often forgotten truth: "Agriculture provides us with the food we all eat every day".

A presentation by Maria Do Céu Silva, Senior Researcher at the University of Lisbon, focused on coffee pathogens and climate change. The farming of Arabica represents 60 per cent of the global production of coffee, she said, and two of the pathogens that limit its production are what are commonly known as coffee leaf rust and coffee berry disease. According to Silva, the most sustainable means of control of these pathogens is to foster disease resistance in coffee plant breeding, which she called "the most sustainable, efficient and eco-friendly strategy for disease control".

Christoph Sänger—Head of Competiveness in the Policy, Strategy and Delivery Department of the European Bank for Reconstruction and Development—used graphs to show the importance of coffee production as an economic sector that provides livelihoods to over 12 million households, mostly in low-income countries. He also highlighted the importance of specific resources—such as financing, certification and markets—that make coffee-growing viable. "The differences in profitability of farming in a region depends on how much farmers have access to these important resources," he said.

And so the opening sessions laid out the major challenges and solutions on the table, while making the broad and sometimes lofty topic of "sustainability" concrete. The only question that remained is: What is the next step? ◘

Q&A ALWAYS CARING FOR NATURE

by **Cristina Serra**

A promoter of soil-saving techniques and a soil-centric approach, Indian Professor Rattan Lal was a distinguished speaker at the Ernesto Illy Colloquia

Sustainable agriculture can help heal the world from the wounds human beings are inflicting to the Earth. The health of soil, plants, animals, people and the environment is, indeed, one and indivisible. As such, it needs protection. This, in essence, is what distinguished soil scientist Rattan Lal thinks and feels, and an idea he encourages at conferences and public events.

A Distinguished Professor of Soil Science and the Director of the Rattan Lal Center for Carbon Management and Sequestration of the College of Food, Agricultural and Environmental Sciences, both at Ohio State University—Rattan Lal has been a TWAS Fellow since 1991. His unceasing commitment to environmental preservation and the sustainable use of the available resources has been at the core of all his activities. He is Goodwill Ambassador for Sustainability Issues for the Inter-American Institute for Cooperation on Agriculture and a member of the 2021 United Nations Food System Summit Science Committee. From 1987 to 1990, he served as the President of the World Association of Soil and Water Conservation.

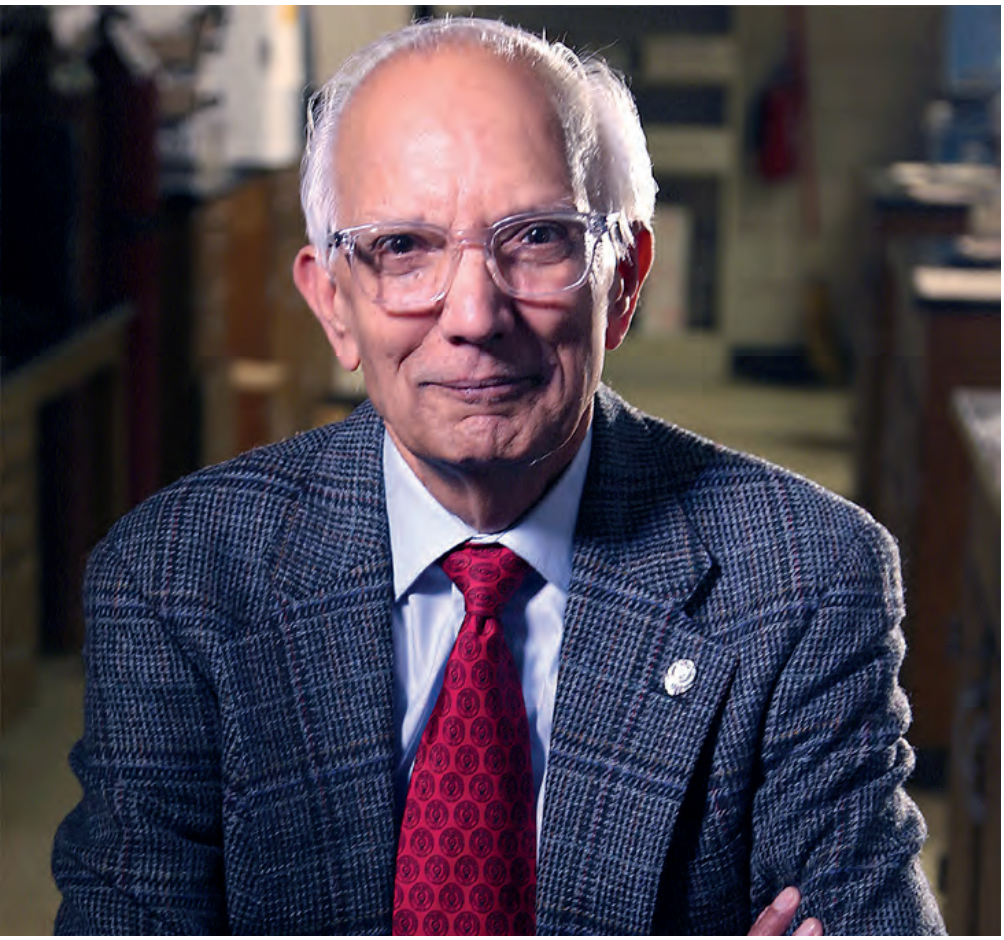
In September, he participated in the round table that ended the 'Ernesto Illy Colloquia: Sustainability challenges in coffee-growing worldwide', when he delivered an important message: Education and training can reconnect people with nature, and policymakers with the real world.

Rattan Lal spoke in a session that featured also Andrea Illy—Chair of illycaffè, Co-founder of the Ernesto Illy Foundation and Co-Chair of the Regenerative Society Foundation—and Jeffrey Sachs, Professor and Director of the Center for Sustainable Development at Columbia University in the United States. In this interview with TWAS staff Cristina Serra, he shared his thoughts on the redeeming potential of sustainable agriculture in the coffee supply chain.

◀ Rattan Lal in an Ohio cornfield. The soil scientist was 2020 World Food Laureate, earning a quarter of a million dollar prize for his pioneering work in soil improvement. (Photo: Ken Chamberlain/Ohio State University)

Prof. Lal, the expression "sustainable agriculture" often leaves some uncertainties about its real meaning. Could you clarify what it is?

● Sustainable agriculture refers to land use and management practices that reconcile the need to increase agronomic productivity and to meet the demand of a growing human



◀ TWAS Fellow Rattan Lal (Photo: Ken Chamberlain/Ohio State University)

> The world is at a crossroads, and there is a strong need for a paradigm shift able to transform the world food systems.
>
> *Rattan Lal*

population with improving soil health and its capacity to provide critical ecosystem services for human well-being and nature conservation. It aims to produce more from less and return some land and water resources back to nature.

Should governments take sustainable agriculture into greater consideration?

● Yes, they should, because today, we are witnessing a per capita global decline in the average arable land, from 0.22 hectares to less than 0.07 hectares, in 30 countries. Renewable freshwater supplies are decreasing, with an impact on more than 4 billion people. We know that the atmospheric concentration of carbon dioxide (CO_2) is growing at a rate of 2.2 ppm or 0.5 per cent per year. If, on top, we add issues such as climate change, wars and political instability, and ecological concerns, it is easy to see that we should roll up our sleeves and start doing something. Where should we start from? From sustainable agriculture.

Children represent the future of the Earth: What would you suggest to them?

Children should know where healthy, nutritious and safe foods come from, along with other ecosystem services. Their alphabet books—in all languages—should be 'soil-centric' and environment-oriented, so that agricultural professions can attract the best and the brightest, once they are grown.

A journey of a thousand miles begins with a single step. Which should be our first step?

● The world is at a crossroads, and there is a strong need for a paradigm shift able to transform the world food systems. Innovative food systems must be based on sustainable agriculture practices, nature-positive strategies and environment-friendly technologies. There is an urgency to identify and implement agricultural policies that support nature, adopting pro-agriculture and pro-farmer practices. Many countries adopted "clean water acts" and "clean air acts"; there is a similar need for "healthy soil acts". The latter would be needed to reward farmers who enhance soil health; re-enrich the terrestrial biosphere (soil and vegetation) with carbon; make agriculture a solution through adaptation to, and mitigation of, climate change; strengthen the provision of other critical ecosystem services, such as improving renewability and quality of freshwater resources; and strengthen biodiversity above and below ground. ◘

Q&A GENETICS TO BOOST COFFEE RESILIENCE

by **Cristina Serra**

Coffee genetics might help devise sustainable growing techniques in support of developing countries, said microbiologist Vittorio Venturi at the Ernesto Illy Colloquia

From fields scattered over green hills worldwide to the billion cups drunk worldwide every day the coffee path is long.

Past trends in the way agriculture was conceived—with the overuse of chemicals—and challenges, such as climate change, energy demand, an ever-growing population that needs food, and market fluctuations are impacting coffee production and small coffee growers.

Scientists, therefore, are studying the genetics of coffee to come up with more resilient varieties, using a sustainable approach, in line with the indications coming from the UN Sustainable Development Goals.

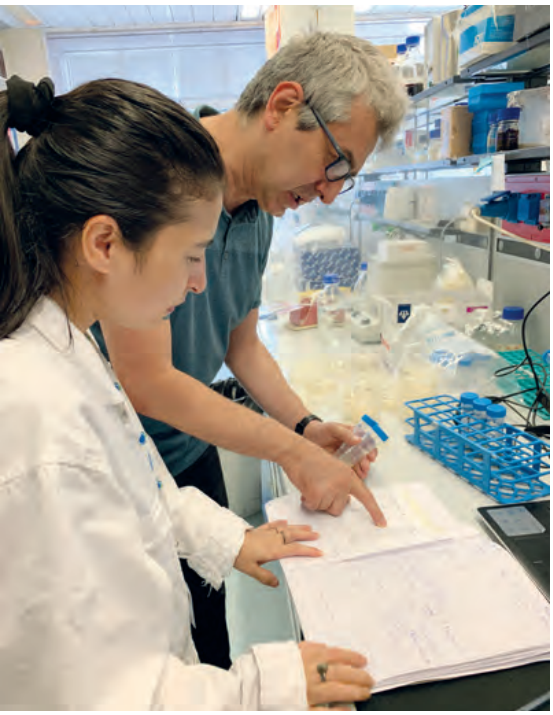
Vittorio Venturi, Group Leader of the Bacteriology Group and Scientific Coordinator of the International Centre for Genetic Engineering and Biotechnology (ICGEB), headquartered in Trieste, Italy, has a deep knowledge of microrganisms that could boost coffee growth without impacting on the environment.

He has been studying soil bacteria for decades, finding that they have an important role in the rhizosphere, the thin layer of soil that is directly influenced by root secretions, where beneficial microbes engage in conversations with plants, in a mutual supportive relationship.

In his presentation at the Ernesto Illy Colloquia, he spoke about the rhizosphere microbiome (the collection of all microbes, bacteria, fungi, viruses, and their genes, living in a certain place, be it the human body or the soil in a forest) of coffee and the potential development of a biofertilizer.

In the following interview with TWAS staff writer Cristina Serra, Venturi anticipated a few key concepts of his presentation.

▶ Vittorio Venturi with part of his international team on the occasion of the PhD of Samson Musonerimana. Together with Vittorio Venturi, S. Musonerimana (first on the right) and Cristina Bez (second on the right) are part of the group involved in the coffee rhizospheric microbiome project. (Photo: ICGEB)



▲ VIttorio Venturi with Nepali scientist Pragati Pradhan, a 2021 winner of a TWAS-SISSA-Lincei Research Cooperation Visits Programme fellowship, during her research visit to ICGEB, in May-July 2022. (Photo: ICGEB)

Coffee is an important commodity for developing countries. What do we know about the genetics of the about 130 existing varieties?

● Of the many existing varieties, the arabica—the DNA of which was sequenced a few years ago by a consortium of partners, including illycaffè and the University of Trieste—holds a prominent position in the global market. Some of the best arabica cultivars come from Ethiopia, Guatemala and India: these places differ in land features, temperatures and precipitations. Knowing the DNA sequence of these plants will allow to identify the genes that might shield them from pathogens and climate stressors, offering better support to the farmers in their daily efforts.

> “Coffee growers should start using the knowledge that science is making available, to make their plantations, and their lives as well, more sustainable.”
>
> *Vittorio Venturi*

A new approach called ‘precision agriculture’ has gained momentum. What is it, and why is it important for coffee?

● Precision agriculture, or smart agriculture, is a farming strategy that takes into account many parameters, including precipitations, wind, moisture levels, soil features, organic matter content and nutrients amounts. These data are collected by real-time sensors and agricultural drones, and used to make models that allow fairly precise predictions. Coffee farmers should learn about these technologies and start using them, so as to grow better crops in the long run.

Why are bacteria important for soil wellbeing?

● Bacteria play a pivotal role for plants: they confer resistance to pathogens, help nutrients uptake from the soil, stimulate the production of growth hormones, and increase stress tolerance. Plants literally recruit these ‘good bacteria’ through a complex system of chemical signalling. If we analyse the soil, we find tens of thousands of good bacteria, which are collectively called rhizosphere microbiome, because they live in close proximity to the roots, in the layer called rhizosphere.

◀ So-called Petri dishes allow growing bacteria, to test their behaviour under different experimental settings. (Photo: ICGEB)

Is the coffee rhizosphere any different from other plants?

● Yes, indeed. Each crop has its specific signature, with some microbes more abundant than others. ICGEB and illycaffè have just started a collaboration aimed to understand what kind of microbes coffee plants usually recruit, to shed light on what they need to grow healthy.

What is the ‘take home message’ of the Colloquia?

● A first outcome would be creating new networks: it’s very important that people involved in coffee production, at all levels, meet and know each other. The second message is ‘science’: we need more research on coffee, and I really hope that companies involved in the coffee business will invest more in research, like illy is doing. The third message involves coffee growers in all countries: they should start using the knowledge that science is making available, to make their plantations, and their lives as well, more sustainable and aligned to the future we all dream of. ◘

THE FUTURE OF SUSTAINABLE COFFEE-GROWING

Early-career coffee researchers from the global South are ready to begin taking action to meet the challenges ahead

by **Sean Treacy**

With the close of the first-ever Ernesto Illy Colloquia, participants from the global South said they not only found themselves equipped with the knowledge to provide motion toward sustainable coffee production, but a community of like-minded people.

"These kinds of events are really important because they help us to connect and to refresh our knowledge," said participant Julio Alvarado Quintana of El Salvador, who is a research technician with the World Coffee Research Breeding Programme, during a round table concluding the event on 29 September.

The first-of-its-kind Colloquia, designed to examine ways to make coffee-growing sustainable on a global scale, were the result of a collaboration between the Ernesto Illy Foundation and TWAS—and four more such events are planned so that participants can follow-up on their progress and continually form new collaborations. Participants in the Colloquia included 20 coffee researchers from developing countries selected by TWAS, and 22 students pursuing the Ernesto Illy Foundation's Master Degree in Economics and Science of Coffee—a unique course that combines online teaching with a month-long residency and in-person lessons in Trieste, Italy, the city where both TWAS and illycaffè are based. These participants were then sorted into five break-out groups, each guided by one of the event's experts, to examine and draw conclusions on the future of coffee production.

On the final day of the Colloquia, the groups offered presentations on their findings, and heard final lectures from distinguished speakers: illycaffè Chair Andrea Illy, TWAS Fellow and Ohio State University soil scientist Rattan Lal, and world-renowned sustainability expert Jeffrey Sachs of the United States. The Colloquia then concluded with a round table that brought together representatives of each of the five break-out groups as they discussed the meaning of the event, and what the next steps could be to ensure the sustainability of the coffee industry.

Alvarado Quintana noted that he was glad to interact with so many fellow researchers who share similar concerns about coffee-growing

◀ Illy Master Degree student Leslie Nanne Lippmann speaks during the Colloquia. [Photo: TWAS]

◀ Participants in the three-day 'Ernesto Illy Colloquia on sustainability challenges in coffee-growing worldwide' working together during one of the event's break-out groups. (Photo: Paola Di Bella/ TWAS)

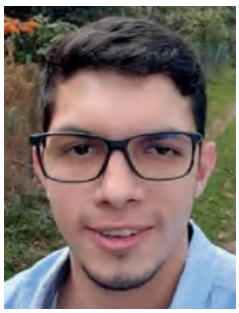
> We as individuals, we are ambassadors now. We need to take action now on the ground.
>
> *Nathan Aliel Kachiguma, Agricultural scientist at Lunyangwa Agricultural Research Station in Malawi*

and climate change. "I'm happy to go back home and take with me the feeling that we are all facing similar problems in our productive systems—in our coffee-growing, and in the environment," he said.

Leslie Nanne Lippmann, an Illy Master Degree student from Guatemala whose family owns a coffee plantation there, agreed. During the round table, she noted that the diverse break-out groups at the Colloquia showed her that everyone is responsible for their role in the coffee-production value chain, even down to the purchases that everyone makes at the supermarket, which she called a "silent vote on what we would like this world to look like."

"For some time I was worried, thinking there are very few people who are actually trying to do something," Nanne Lippmann added. "So it was a breath of fresh air for me to hear the speech from Andrea Illy, and realize that there are people in important positions who can mobilize people, and mobilize ideas in the world in order to nudge it towards a brighter future."

▼ From top: Julio Alvarado Quintana, Nathan Aliel Kachiguma, and Daphne Nyachaki Bitalo (Photo: TWAS)



After the round table, participants were still abuzz with ideas from the conference. One participant, Nathan Aliel Kachiguma, an agricultural scientist with Lunyangwa Agricultural Research Station in Malawi, said he was thankful for the chance to attend, as it was an opportunity to hear a diverse array of experts across the industry—from geneticists, to soil scientists, to coffee industry leaders.

"I think there's a need for more action points after the fruitful discussions during the Colloquia. We as individuals, we are ambassadors now. We need to take action now on the ground," said Kachiguma. "Now, it's time for me to go back and share the knowledge that I've learned here with my colleagues. I think this is a very good initiative and I look forward to more."

The event usefully highlighted the disparities between countries that produce coffee, and those that do not, observed participant Daphne Nyachaki Bitalo, a researcher and geneticist at the National Coffee Research Institute in Uganda. She also said that she had engaged in discussion to expand the involvement of women in coffee industry research, including strengthening chapters of the International Women's Coffee Alliance.

"I was speaking to one of the women from Indonesia, and she was saying their chapter is a bit silent, and some of the countries were saying they don't have a chapter," said Bitalo. "So we're liaising with each other to try to get everyone on board to have such chapters and bridge that gender gap."

In the long-term, it will be up to these young scholars to set the priorities and form the collaborations that can reshape coffee production. In the meantime, the four remaining Ernesto Illy Foundation-TWAS events in the years to come will play a role in facilitating these new efforts, as they emerge and innovate their way to a more sustainable future. ◘

Here are some scenes from the 'Ernesto Illy Colloquia: Sustainability challenges in coffee-growing worldwide', in which early-career researchers, seasoned scientists, and policy experts gathered to puzzle out solutions for making the coffee industry sustainable in a challenging future.

▲ Get-together discussions during coffee breaks.

▼ Attendees applaud at the end of a presentation.

▼ Giacomo Celi, Tropical Agronomist, Mercon Coffee Group, United States of America, asking a question during the Ernesto Illy Colloquia.

▲ Speakers during the Ernesto Illy Colloquia, from left: Serena Tonel, Deputy Mayor of Trieste, also in charge of Economic Policy; Alessia Rosolen, Regional Councillor for Work, Training, Education, Research, University and Family; Furio Suggi Liverani, Chief Scientific Officer of illycaffè, Director of Ernesto Illy Foundation; Romain Murenzi, TWAS Executive Director; Atish Dabholkar, Director of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

▼ Attendees engaging in discussions during the breakout groups of the Ernesto Illy Colloquia.

All photos are by Paola di Bella/TWAS

▼ Tonjock Rosemary Kinge, an Associate Professor at the Department of Biological Sciences, Faculty of Science, the University of Bamenda, Cameroon, asks a question during the Ernesto Illy Colloquia.

▲ Attendees engaging in vibrant discussions during the breakout groups. Centre (standing): Benoît Bertrand – Research Director, French Agricultural Research Centre for International Development (CIRAD), France.

▼ Relationships and partnerships, at the Colloquia, sometimes arose around a cup of coffee.

▲▼ Attendees engaging in discussions during the breakout groups at the Ernesto Illy Colloquia.

▲ Max Paoli, TWAS Programme Coordinator, asking a question during the Ernesto Illy Colloquia.

All photos are by Paola di Bella/TWAS

CIRCULAR ECONOMY FOR SUSTAINABLE GROWTH

TWAS round table at Trieste Next explored the importance of the idea of a 'circular economy', to implement sustainable growth in developing countries

by **Cristina Serra**

Sharing, leasing, reusing, repairing, refurbishing and recycling are the building blocks of a circular economy, a model of production and consumption that aims to preserve the value of already manufactured materials, components and products through a new intended usage.

According to a World Bank report, global annual waste generation is expected to jump to 3.4 billion tonnes over the next 30 years, up from 2.01 billion tonnes in 2016. These data call for urgent measures taken at all levels.

At the 2022 international science festival Trieste Next (22–24 September)—this year in its 11th edition and all in presence, for the first time after the COVID-19 pandemic—TWAS organized a round table titled 'Circular economy and biotechnology for sustainable development in the global South'. Its aim was to address the role that 'circular economy' can play in to releasing scientifically struggling countries from an endless cycle, allowing them broader participation in the international scene.

The event, which took place on 23 September, brought to the stage three panellists who explored the importance of the concept: Lucía Pittaluga, a Professor of Economic Development with the Universidad de la República, in Montevideo, Uruguay; Muntaser Ibrahim, a Professor of Molecular Genetics in the Department of Molecular Biology, Institute of Endemic Diseases at the University of Khartoum, Sudan and a TWAS Fellow since 2007; and Maria Colurcio, a Professor of Management at the Magna Graecia University of Catanzaro, Italy.

The panellists offered intertwined views of a complex, yet fascinating field that includes science and technology, social issues, and economical policies. TWAS Programme Coordinator Max Paoli chaired the round table, which was hosted in the prestigious Palace of the Presidency of the Friuli Venezia Giulia Region, in the central Piazza dell'Unità d'Italia in Trieste, Italy, the home city of TWAS.

THE INTERNATIONAL PERSPECTIVE

Lucía Pittaluga, whose current scientific interest is in sustainable circular bioeconomy, is also a consultant to multilateral development institutions and government agencies in Latin

▼ Professor Muntaser Ibrahim and TWAS Executive Director Romain Murenzi, in front of TWAS gazebo, in Piazza dell'Unità d'Italia, Trieste, on 23 September 2022. (Photo: TWAS)

▶ TWAS Programme Coordinator Max Paoli answers a question from the audience. (Photo: TWAS)

America. Her presentation focused on the future of food systems in Latin America and the Caribbean, reflecting on its potential role in the circular economy.

To be applied at a global scale, circular economy—which is based on the three pillars of "reduce, reuse, recycle"—would require a systemic change, Pittaluga said. Highlighting the importance of being frugal, she added: "We need to move from a lifestyle based on nice-to-have, to an approach based on need-to-have, to avoid overexploitation and useless waste. The idea of 'enough' should be the guiding principle of our lives."

Then she mentioned three major productive areas that are a priority for the circular economy in Latin America and the Caribbean: the mining and extractives sector, waste management and recycling, and the food systems. Regarding the food system, Pittaluga observed that some major forces are locking the food system in its current unsustainable trajectory. These forces are technological innovation, which is driven by profit and not by the ethics of sustainability, and the failure of science to play its role in this critical debate.

> "We need to move from a lifestyle based on nice-to-have, to an approach based on need-to-have, to avoid overexploitation."
>
> *Lucía Pittaluga*

Another panellist, Muntaser Ibrahim, focused his presentation on the diaspora of scientists from the global South, who are a resource for the hosting countries. "The potential of many mature scientists is wasted or not fully utilized," said Ibrahim, who is also a founding member of the Sudanese National Academy of Sciences

▼ From left: Lucía Pittaluga, a Professor of Economic Development at the Universidad de la República, in Montevideo, Uruguay; Maria Colurcio, a Professor of Management at the Magna Graecia University of Catanzaro, Italy; Muntaser Ibrahim, a Professor of Molecular Genetics in the Department of Molecular Biology, Institute of Endemic Diseases at the University of Khartoum, in Khartoum, Sudan and a TWAS Fellow since 2007.

ONE EARTH, ONE HEALTH, ONE FUTURE

The idea of a planet where all the living organisms are interconnected and prosper in a mutually interdependent fashion may not be self-evident.

But the truth is that each living component affects the others and each may end up being beneficial or noxious. Therefore, we should all participate in a responsible and sustainable manner to the global welfare, because our health is everybody's health, and the future depends on every single step we take.

This was the core message of TWAS Editor Raffaella De Lia, who gave the chance to high school students from Liceo Scientifico Galilei, in Trieste, to get to know the 17 UN Sustainable Development Goals (SDGs) and their relevance at the global level.

The event, held in English, took place on 26 September as part of Sharper - The European Researchers' Night, an international event dedicated to the dialogue between research and citizens, co-financed by the European Commission in the framework of the Marie Skłodowska-Curie Actions.

By asking pointed questions, she encouraged active participation and invited the students to elaborate on and make explicit their idea of sustainability. More than 50 students were in the audience and shared smart ideas and potential solutions to some of the challenges that the world is facing, proving with their passion that building our common future starts now. ◘

▲ TWAS Editor Raffaella De Lia showed students from Liceo Galilei in Trieste the importance of living by adopting a sustainable approach in a public Researchers' Night event. (Photo: TWAS)

and the African Society of Human Genetics whose research addresses the evolutionary aspects of diseases in relation to human genetic diversity.

"We should see scientists as a rare commodity and include them in the concept of cyclical economy, thus allowing a better usage of their talent and capacities," he said.

With the current challenges that the world is facing, making use of scientists' skills is becoming mandatory, he added. "We have inspiring examples of scientists who experienced a diaspora, and who made a tremendous impact through very short liaison with native institutions, increasing prospects of development by transferring knowledge, skills and technology."

ITALIAN CASE-STUDIES

The third panellist, Maria Colurcio—an expert on new service development and service innovation, social innovation and value creation—offered examples focused on Italy, where the recycling rate is higher than in the rest of Europe (68 percent compared to the European average of 35 percent).

She mentioned some young Italian entrepreneurs from Turin who set up a start-up based on recycled materials: they found a way to reuse unsold bread, turning it into a natural beer. Since bread contains both sugar and yeast, they were able to reduce the use of raw materials by up to 30 percent.

In another case, two young Italian women created fabrics out of orange waste peels. Now, these fabrics are used by Italian brands to realize fashionable orange-based collections of outfits. Coffee leftovers can be used to produce ecological coffee pellets for the stove, Colurcio explained.

"Business models that are sustainable from the environmental and social point of view are essential today," Colurcio maintained. "We should aim at improving two sectors: the eco-design of products, focusing on durability and the reuse of products, and the circularity of production processes, developing regenerative bio-economy." ◘

PIONEERING PHYSICS

For paving new avenues in quantum information science, TWAS Fellow Anton Zeilinger received the 2022 Nobel Prize in Physics

by **Cristina Serra**

Anton Zeilinger, John Clauser and Alain Aspect have each conducted groundbreaking experiments using entangled quantum states, where two particles behave like a single unit even when they are separated. The Royal Swedish Academy of Sciences awarded these three scientists the 2022 Nobel Prize in Physics "for their experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science."

A TWAS fellow since 2014, Anton Zeilinger is a quantum physicist and Professor Emeritus at the University of Vienna, Austria. He is also the former President of the Austrian Academy of Sciences (ÖAW) and an active supporter of TWAS. From 2004 to 2013, he served as the Director of the Institute for Quantum Optics and Quantum Information with the Austrian Academy of Sciences, and today is a member of many academies, including the German National Academy of Sciences, Leopoldina. During his career, he established professional collaborations with China, France, the U.K., and the U.S..

Zeilinger is a pioneer in quantum physics—the study of matter and energy at the most fundamental level—and its applications to quantum information technology, a rapidly emerging technology that harnesses the laws of quantum mechanics to solve problems too complex for conventional computers. In fact,

▶ Anton Zeilinger, former President of the Austrian Academy of Sciences, at the opening ceremony of the 13th General Conference and 26th General Meeting in Vienna, Austria, on 18 November 2015. (Photo: Michael Weinwurm/ÖAW-TWAS)

the field of quantum information is among the most promising in science today: acting at the atomic and subatomic levels, its applications include not only secure encrypted communication, but also simulation of physical systems, finance, materials science and healthcare.

Among other things, his research group has demonstrated a phenomenon called quantum teleportation, which makes it possible to move a quantum state from one particle to another one at a distance.

"We all know teleportation from [the science fiction TV show] Star Trek and so on, where somebody's transported. Teleportation in quantum physics is somewhat different," Zeilinger told Nobel Prize Outreach.

In quantum physics, Zeilinger explained, teleportation is "a transfer of information from one object to another one without actually knowing the information."

"This is one of the basics of how future quantum computers can talk to each other," Zeilinger added.

"It has become increasingly clear that a new kind of quantum technology is emerging. We can see that the laureates' work with entangled states is of great importance, even beyond the fundamental questions about the interpretation of quantum mechanics," said Anders Irbäck, Chair of the Nobel Committee for Physics.

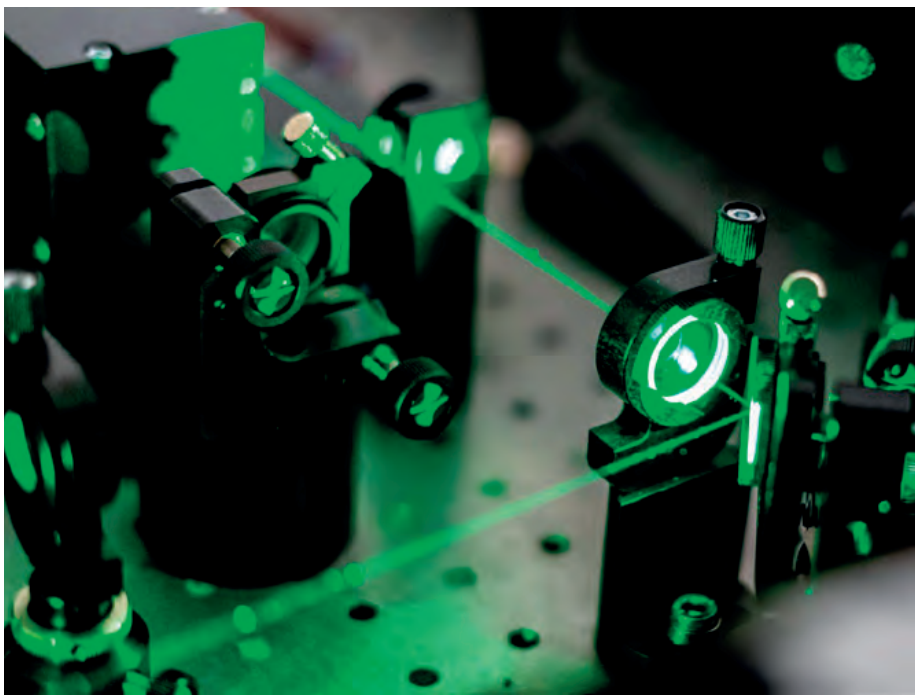
Zeilinger's ties with TWAS are strong: he played a key role in the hosting and organization of the TWAS 13th General Conference and 26th General Meeting, held in Vienna from 18 to 21 November 2015, when he was the President of ÖAW.

"We considered the invitation from the Austrian Academy of Sciences, and from our friend Prof. Zeilinger, to host the Meeting to be an important recognition of TWAS's growing role in helping to bridge the gap between the developing and the developed world," recalled TWAS Executive Director Romain Murenzi. "During his tenure as ÖAW President, Zeilinger himself was very supportive of our mission and activities, and his professional career clearly shows his dedication to fostering scientific cooperation at the international level."

"As highlighted in our current strategic plan, we want to make the advances of science and technology available to all, in every corner of the world," Murenzi added. "This includes advances in quantum cryptography, one of the fastest-growing areas in quantum information science. Therefore, we look forward to working with him in the years ahead, to build scientific capacity in this field, especially in the global South."

> "It has become increasingly clear that a new kind of quantum technology is emerging."
>
> *Anders Irbäck, Chair of the Nobel Committee for Physics*

"Anton Zeilinger is a world-renowned scientist and a good friend to TWAS," emphasized TWAS President Mohamed H.A. Hassan, President of the Sudanese National Academy of Sciences, Chair of the UN Technology Bank for the Least Developed Countries and former Chair of the Council of the United Nations University. "As such, he is naturally close to the Academy's mission, which includes promoting science and technology in developing countries and acting



▼ Experimental device used to teach quantum physics [see www.akademietraunkirchen.com]

▲ Austrian Academy of Sciences former President Anton Zeilinger at the opening ceremony of the 26th TWAS General Meeting in Vienna, Austria. [Photo: Michael Weinwurm/ ÖAW-TWAS]

in line with the UN Sustainable Development Goals to eliminate poverty, and hunger, promoting higher education and gender equality."

But Zeilinger is also an incredibly prolific scientist who always dared to explore uncharted territories of physics, Hassan added.

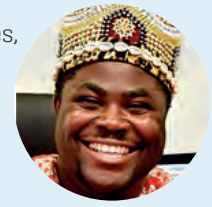
"This most important international recognition in physics is truly deserved: the potential implications of his discovery, so far mostly unexplored, will impact not only physics but other fields as well, bringing clear benefits also to the global South by creating more jobs and propelling the developing countries towards the international scene."

In addition to his strict scientific activities, Zeilinger has carried out other professional initiatives that go beyond physics, including the creation of the Institute of Science and Technology Austria (IST Austria) and the creation of the Internationale Akademie Traunkirchen, a small student academy to motivate and excite young students from primary school to high school for the sciences, mathematics, and engineering. ◘

PEOPLE, PLACES & EVENTS

ABDON ATANGANA NAMED SECOND BEST MATHEMATICIAN IN THE WORLD

Cameroonian scientist **Abdon Atangana**, a 2022 TWAS Fellow and a Full Professor of applied mathematics at the Institute for Groundwater Studies, University of the Free State in Bloemfontein, South Africa, was ranked number two in general mathematics in the world.



The nomination comes from Stanford University's Top 2% of Scientists in the World list, where Atangana also scores 188th worldwide in science, technology, and engineering.

His name is linked to the development of a new mathematical function (technically called a fractional operator), used to model real-world problems in various fields including engineering, science and technology. Atangana has devised numerous mathematical operators, which are now named after him (Atangana-Baleanu derivatives and integral, fractal-fractional derivatives and integrals, piecewise differential, and integral calculus), and have earned him an international reputation.

His work has been acknowledged with international awards, including the 2020 Obada Prize, and the first ever TWAS-Hamdan Award (2020).

IN MEMORIAM: ADEREMI O. KUKU

Aderemi O. Kuku, a distinguished Professor of mathematics at the National Mathematical Centre in Abuja, Nigeria, and the Immediate Past President of the African Academy of Sciences passed away on 13 February 2022.

Kuku, a TWAS Fellow since 1989 and a distinguished scholar, was also a former President of the African Mathematical Union, and a member of the International Mathematical Union Commission on Development and Exchange.

From 1995 to 2003, he was a staff member of the The Abdus Salam International Centre for Theoretical Physics, in Trieste, Italy.

His scientific career was spent mainly at the University of Ibadan, in Nigeria, where he became Full Professor of mathematics in 1982. Then, from 1983 to 1986, he served as the Head of the Mathematics Department, and from 1986 to 1990 as the Dean of the postgraduate school.

His numerous recognitions include: the Nigerian National Order of Merit, the highest honour in Nigeria for academic excellence; the Officer of the Order of the Niger. In addition, he was an esteemed Fellow of the American Mathematical Society, and of the Mathematical Association of Nigeria.

IN MEMORIAM: FRANÇOIS GROS

François Gros, a TWAS Fellow since 2003 and a former President of the Institut Pasteur (from 1976 to 1981) and Director of Research at the French National Centre for Scientific Research, passed away on 18 February 2022.

Gros's scientific career started at the Institut Pasteur, where he joined in 1946 as a PhD student in biochemistry. He earned his PhD in 1952, then moved to the United States, where he completed his postdoctoral research first at the University of Illinois, then at the Rockefeller Institute, in New York.

Upon returning to France, he worked at the Institut Pasteur's Biochemistry Department, at that time led by Jacques Monod. In 1963, he took over as Head of the Microbial Physiology Department, at the Physical and Chemical Biology Institute, in Paris, and from 1972 to 1995, he led the Biochemistry Unit at the Institut Pasteur.

Gros was elected as a member of the French Academy of Sciences in 1979, where he later served as permanent Secretary, from 1991 to 2001. He was Emeritus Professor at the Collège de France and Pasteur Institute and a member of the Royal Academy of Belgium, the American Academy of Arts and Sciences, and the Academy of the 40, Italy.

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ISSN 2222-7369

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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 global South and global North, under the leadership of Abdus Salam, the Pakistani physicist and Nobel laureate. Today, TWAS has more than 1,300 elected Fellows representing over 100 countries; 12 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 almost four 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 more than 300 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 over $2 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 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 8,200 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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ICTP

iap SCIENCE HEALTH POLICY
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