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A Surge of Innovation

The state of science in the Arab Region



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▲ [top] Ain Beni Mathar Thermo Solar Power Plant, Morocco [Dana Smillie/ World Bank]; [below] To develop a culture of innovation, the Kuwait Foundation for the Advancement of Sciences has a special programme to support the nation's top young students. [Photo: KFAS Sabah Al Ahmad Center for Giftedness and Creativity]

Cover: An aerial view of the solar mirrors at the Noor 1 Concentrated Solar Power plant outside the central Moroccan town of Ouarzazate. [Photo: Fadel Senna/AFP]

▼ The first ring cell of the storage for the Synchrotron-Light for Experimental Science and Applications in the Middle East [SESAME] in Jordan. [Photo: SESAME]



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EDITORIAL

SIGNALS OF HOPE FROM ARAB SCIENCE



▲ Mohamed H.A. Hassan,
TWAS executive director
[interim]

In early 2017, the government of Lebanon approved an ambitious renewable energy plan: It would generate enough power from solar, wind and other sources by 2020 to meet 12% of its need, triple the current capacity. Morocco is going even further, projecting 42% of its power from renewables by 2020 – and 52% by 2030.

We live in anxious times, and hopeful stories like these are often overtaken by bad news. Perhaps that's understandable: the current turbulence in the Arab Region has global implications for security, and for science.

And yet, Morocco and Lebanon are sending vitally important signals: even in a time of challenge and uncertainty, scientists, engineers and policymakers are advancing development through innovation. Today, such signals are rising from throughout the Arab Region.

This special issue of the TWAS Newsletter captures a number of them:

The region is synonymous with oil, but from Saudi Arabia to Algeria, governments and utilities are turning to green energy.

SESAME – the Synchrotron-Light for Experimental Science and Applications in the Middle East – opened in Jordan in 2017, and will be a major centre for regional research and cooperation.

A new generation of science leadership includes some remarkable women – Princess Sumaya bint El Hassan, president of the Royal Scientific Society in Jordan; Hayat Sindi of Saudi Arabia, the science adviser to the Islamic Development Bank and member of the UN Secretary General's Scientific Advisory Board; and Samira Omar Asem, director general of the Kuwait Institute of Scientific Research and treasurer of TWAS.

The 2017 World Science Forum was set for Jordan, chaired by Princess Sumaya, an event that embodies the region's growing commitment to scientific leadership.

Of course we need to see the world clearly: this remains a time of acute challenge.

In countries such as Syria, Iraq and Yemen, conflict has damaged labs, closed universities and driven thousands of scientists, engineers, medical professionals and students to flee. Jordan, Lebanon and Turkey, to their credit, have taken in millions of refugees, including scientists and students.

If we take the long view, the Arab region must respond to the broad challenges by investing more in research, development and education. Sustained commitment is required to drive economic growth, create jobs and address climate change, water shortages and other challenges.

From its earliest days, TWAS has been committed to the Arab region, and today the Academy and its affiliates are expanding the effort. A TWAS science diplomacy workshop in Trieste, Italy, focused on refugee scientists. The Organization for Women in Science for the Developing World [OWSD] held a workshop on research publication in Khartoum, Sudan. The InterAcademy Partnership [IAP] works with national and regional Arab science academies.

Indeed, we have many vital partnerships in the region. The Kuwait Foundation for the Advancement of Sciences has long provided valued support for TWAS communication and other programmes. The Bibliotheca Alexandrina provides robust support for our Arab Regional Office. With COMSTECH, we provide research grants in Organization of Islamic Cooperation countries.

In these times, TWAS and its partners see the potential for positive impact. Working together, we can continue to build the advances, opportunities – and hope – that are essential for peace.

Mohamed H.A. Hassan
TWAS Executive Director [interim]

TWAS NEWSLETTER

Published quarterly by The World Academy of Sciences for the advancement of science in developing countries with support from the Kuwait Foundation for the Advancement of Sciences (KFAS).

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Printing

La Tipografica Srl
Campofornido, Udine, Italy

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Printed on Fedrigoni Arcaprint 1 E.W., a paper made with environment-friendly ECF pure cellulose, FSC certified.



IN THE NEWS

Central America faces climate information gap

An online survey of 105 public officials found that decision-makers in Central America lack the scientific information they need to effectively operate climate change mitigation programmes, especially those designed to help small farmers.

The survey said creating maps is a good starting point for improving communication, and the information is usually available, but only in technical formats, which never reach the offices of deputy ministers or programme heads.

SciDev.Net:

www.bit.do/ClimatelnfoGap

Indigenous groups fight to protect forested land

Indigenous groups in Brazil control large reserves in the Amazon and have the constitutional right to more. But land thieves and agribusiness are working to prevent recognition of new indigenous territories — forested areas that, if protected, could sequester a great deal of climate change-causing carbon.

According to 2014 data for Legal Amazonia, 59% of that year's illegal deforestation occurred on privately held lands, 27% in conservation units, 13% in agrarian reform settlements, and a mere 1% on indigenous lands.

Mongabay:

www.bit.do/Indigenous-Land

Mental illness plagues Kashmir Valley

As much as 45 per cent of the population of the Kashmir Valley is suffering from mental distress, says a survey conducted by international humanitarian organisation Médecins Sans Frontières (Doctors Without Borders). The research underscores an urgent

need for comprehensive mental health provision in the valley.

The survey highlights that 1.8 million adults in the valley show symptoms of significant mental distress. According to the survey, 41% of people exhibit symptoms of probable depression, 26% show symptoms of probable anxiety and 19% show symptoms of probable Post-Traumatic Stress Disorder (PTSD).

Down To Earth:

www.bit.do/KashmirDistress

To protect glaciers, India grants them legal personhood

An Indian court granted Himalayan glaciers status as “legal persons” in a new conservation strategy.

The Gangotri and Yamunotri glaciers as well as waterfalls, forests, lake, meadows and other environmental features in the region have all been granted legal rights as “living entities.” The glaciers are among the largest in the Himalayas and feed into the Ganges (Ganga) and Yamuna rivers. However, they are receding at an “alarming rate,” judges said.

The Humansphere:

www.bit.do/GlacierPersonhood

Kenya tourism, conservation threatened by drought

Kenya is one of the several East African nations affected by a harsh drought, with the Red Cross reporting that 3 million Kenyans are in need of emergency food aid. Cattle herders have invaded luxury lodges, ranches, and conservancies in search of fresh pasture for their herds.

The spike in invasions has also left a bloody trail, with a dozen people dead, including mothers and children. Tristan Voorspuy, a dual Kenyan and British national, was also found dead in early March 2017 after he ventured to inspect burnt houses at the Sosian safari lodge.

Quartz:

www.bit.do/KenyaDrought



Q&A ARAB SCIENCE: A VISION OF HOPE

Three Arab science leaders say that to support development, jobs and peace in the region, policymakers and the public must deepen their commitment to research and science education.

The Arab World extends from Oman in the east to Morocco in the west, and across the span of 22 countries there is extraordinary richness and diversity – distinct but often interwoven histories, varied cultures and values, extremes of wealth and poverty. And, as with all countries on Earth, the Arab countries face a range of challenges, many linked to science.

For perspective on the state of science in the Arab region, TWAS interviewed three important partners: TWAS Fellow Adnan Shihab-Eldin, director general of the Kuwait Foundation for the Advancement of Sciences; Mostafa el Feki, director of the Bibliotheca Alexandrina in Egypt, which hosts the TWAS Arab Regional Office; and Rafia Ghubash, president of the Arab Network for Women, Science and Technology, which is hosted by the Bibliotheca.

Though each brings a unique view, there are points of convergence: Especially in North America and Europe, they say, few recognise the historical achievements of Arab researchers, or the growing influence of Arab women in modern science and engineering. At the same time, they said, much must be done to strengthen Arab science so that it can support economic development

and peaceful prosperity. And science diplomacy could be critically important – if Arab leaders develop its potential.

The interviews were conducted by Edward Lempinen, the TWAS public information officer.

In general terms, how would you describe the state of science and research in the Arab region?

Shihab-Eldin: Despite the promising growth in higher education and research institutions, the scientific research system within the Arab region continues to be hindered by the lack of a clear and unified vision for the role of science, innovation and technology [STI] in development. This has resulted in limited investments by governments and the private sector within the Arab region, directed towards research and development [R&D], evident by the

very low percent contribution of their gross domestic product [GDP] to R&D, which is an integral part of developing a knowledge-based economy for national and regional sustainability. This has also led to policies and outputs with modest public awareness and appreciation of science in addressing a range of challenges facing the region, such as socioeconomic growth, human development, extremism and ignorance.

Ghubash: Generally, it is so difficult to assess the Arab world as one country, because there are huge differences between one region and another, with regards to economy which affects the outcome of education. Therefore, it could be more logical to divide the region according to other indicators which will include the income, size of population and also other factors. To answer your question, we have to have some valid statistics based on good studies. But in my opinion, being president for a regional university before as well as being dean of a medical school, there is some good evidence that some of the Gulf countries achieved global ranking with regards to scientific publications.

“ There are many notable contributions of Arab scientists in the advancement of research at the local level. However, most of the quality output is produced through international collaborations. ”

Adnan Shihab-Eldin

el Feki: I must tell you frankly it is very poor. You know, the Arabs are divided into two sections: The rich countries sometimes are not using their money for scientific research, and the poor side, they are often saying that they don't have enough money to cover the costs of scientific research. But both are not correct. You know, scientific research does not require the cost that poor countries are talking about, and the rich countries, it's to their advantage to use as much as they can of their wealth to build up the future through scientific research.

More specifically, what challenges currently confront science in the region? And what opportunities do you see?

Shihab-Eldin: At the forefront of the challenges confronting science in the region is the lack of appreciation for and value in scientific research in the society, starting at the governmental

level, as indicated by the limited government resources for R&D, to individuals within the community. Thus, a large portion of scientific research performed in universities and institutes often does not lead to applications that can be utilized for the enhancement of other segments of the society, such as the private sector's products and services. Developing sustained policies and plans by governments for spending on R&D will ensure greater success in building a knowledge-based economy and long-term sustainability, allowing for the translation of scientific research into applications benefiting all factions of the society. One opportunity that we must capitalize on is the fact that in nearly every country within the region, more than half of the population is under 30, presenting a unique occasion for promoting STI capacity-building through innovative formal and informal channels, ensuring that the future development of the region is linked to increased investment and competency in STI.

Ghubash: The Arab countries should be serious about shifting to investment in knowledge and give it a priority, and share this concern with their nations so that everything should be geared towards investment in knowledge, curriculum of schools, universities and higher education to implement such a concept. As well as companies which should be the leading institutions to encourage learning and development among their employees and to reduce the gap between the importance of and the readiness for learning and development. Research has shown that not even a quarter of companies are comfortable with modern learning environments. Clearly, more needs to be done. But there are opportunities: Most of the Arabic countries are young – 60% of their population is younger than 20 years. And the Gulf region is rich and could spend more on scientific research and education.

el Feki: I want their vision through scientific research to be changed, toward science. It's not a luxury. It's not an extra issue. It is an essential element for progress and for building up the future. That's why we have to concentrate on this point and avoid the previous understanding that science is only done by the West and that it is not something done in our part of the world. Because I must tell you frankly Westernisation is not the only path to modernisation – no. Modernisation could be made through national experiences – like China, Japan, India. I hope the Arabs will follow the same steps.

In Europe and North America, do you think that policymakers and people generally have a good awareness of science in the Arab region?

Shihab-Eldin: There is a little, if any, understanding and appreciation by the West about the rich history of the Arab



Adnan Shihab-Eldin



World in the advancement of scientific disciplines, such as astronomy, mathematics and chemistry, dating back to the 9th and 10th centuries. Arab scientists have continued the tradition of science by contributing to the furthering of many scientific disciplines, but most who have made notable, internationally recognized and acclaimed contributions, such as Nobel Prize winners, established research careers outside of the region, predominantly in Western Europe or North America. In the 21st century, we are seeing the promising results of R&D efforts in a few newly established and government-supported institutions in the Gulf states, and in some instances, governments have adopted research strategies as a part of their national development plans. This is still nascent. Building a solid and active innovation ecosystem involves a series of intricately connected institutions and complex structures, which takes much effort, time, and the cooperation of every part of the economic and social framework in a society. While a great deal has been accomplished in countries within the Arab region, in most societies, we have yet to master the nuances in this complex process, and the integration of all the parts of an effective innovation ecosystem within the whole fabric of our society. This involves more spending by the government and private sector on research and development, which is a must. But just as important is an enabling platform for policy change and human capital development.

Ghubash: Not at all. They are very ignorant about the situation and they only see the negative aspect in this part of the world which is the result of the wars inside and among Arab countries for the last 100 years. A war which is triggered by the West for unjustified reasons. Politics has a large effect on the learning and development



Rafia Ghubash

of this region. However, very few European institutions have provided support to scientific centres or universities in the Arab region and also recruit Arab scientists, which makes a difference in the outcome. I wish and hope that one day the curriculum in the European countries include the role of Arabs in science in the early history to change the stereotype and for the West to understand and be aware that Arabs have potential to be involved in science and technology if they live in fair and stable environments.

el Feki: I want to tell them, whenever you encourage scientific research in the other countries, it will help to have an impact on poverty. Poverty is like a time-bomb everywhere. And reducing poverty will defuse terrorism. If they want to defuse terrorism, they have to upgrade the standards of living in these countries. One of the main messages to them is to go ahead with scientific research, encourage science, and give more attention to education.

At the end of the day, after maybe one decade or a little more, you'll see that the phenomenon of terrorism will start to disappear.

Do you see growing interest in science and technology careers among young people in the region?

Shihab-Eldin: There are certainly some encouraging signs, such as the rise in the number of STEM graduates within the region. However, to change the current STI culture, tsunami-like policies are needed to increase the youth's engagement and appreciation for science, and to motivate the government to significantly increase R&D investment. This will lead to not only STEM graduates, but an increase in qualified professionals in STI fields. Currently in the Gulf countries, a good portion of STEM graduates end up in the public sector, rather than the productive private sector. This trend needs to change, and policymakers can

“ The Arab countries should be serious about shifting to investment in knowledge and give it a priority, and share this concern with their nations so that everything should be geared towards investment in knowledge. ” *Rafia Ghubash*

play a central role. KFAS is tackling these challenges by encouraging the public and youth to appreciate science through formal and informal engagements, and by working with the private sector to advance and improve their STI capabilities, presenting rewarding career opportunities for recent graduates.

Ghubash: Studies show that the relative share of S&T students among the overall student population has been falling in the European countries. As for the status in the Arab countries, there are no data to evaluate the situation. Research should be encouraged and supported by organisations like TWAS or the UNESCO to be carried out and evaluate the conditions. Policymakers are trying to encourage interest in science, but unfortunately there is no clear national vision about what should be done.

el Feki: Let us hope – sometimes they are talking about this. And you know, if you just take it by numbers, we have thousands of schools, we have tens of thousands of teachers. But the education process is stale, it's from the past. They have to think with modern styles and means of education. The educational process should be modernised, should be updated. This is the point. No, you don't need simply to put in the minds of children more information. No – you have to teach them how to think, analytic approaches, methodology, the way of thinking, priorities. These are all means and ways of modern education, but they're not there right now.

Are there social or cultural obligations unique to the Arab countries that create limitations or challenges for women scientists?

Shihab-Eldin: Traditionally, there has been an inherent pressure, on women from all over the world, in balancing a professional career with the responsibilities of family and personal life. The Arab World is no exception, but, recently, there are promising trends that showcase the prominent role of Arab women in science and technology. The UNESCO Science Report notes that some 60% of Arab STEM graduates are women, and the Economist reported that over 25% of Arab start-ups are founded or led by women. Yet more needs to be done to support women in STEM majors and careers and to increase their presence in leadership positions. Women need a strong support system, involving everyone from government officials to families and friends. In October 2017, KFAS hosted the “Women Leaders in Science, Technology and Engineering Conference” [link: <http://bit.ly/2FZS5Nz>], which focused on empowering women scientists and promoting their rights and advancement. Ultimately, the true potential of any society will continue to rely on the contribution of the intellect, innovation and creativity of both men and women.

Ghubash: Not at all, the real situation is that we in the Arab region have more

female students applying for medical, engineering and scientific majors in comparison to male students. Recently in the UAE, five female teachers were the winners for scientific awards for their inventions.

el Feki: No, I tell you this is not as before. We have talented young girls and ladies concentrated on their own scientific careers, and they are not much worried about marriage and social life and family. They are thinking of their future as scientists. That's why the differences between males and females in that regard have started to disappear. We have many scientific researchers among the ladies and girls. Women are invited like men to participate in scientific research and to work in science. Especially in the educational system, among school teachers and administrators, women are sometimes more or less equal in number to the males, 50 to 50. That's why their role is not too far equal in science and scientific research. They are invited and we have very broad-minded university professors in very specialised areas of science. This we can't ignore.

How would you assess the current state of regional scientific cooperation among Arab countries?

Shihab-Eldin: The answer: weak at best. There are many notable contributions of Arab scientists in the advancement of research at the local level. However, most of the quality output is produced through international collaborations. Regional organisations or regional branches of international organisations need to do much more to promote and support regional cooperation in STI in the region. There are examples of success stories towards this end: Tech start-ups are booming in the Middle East, such as the recent acquisition of Souq.



com by Amazon, and the success of Careem, the region's fast-growing ride-sharing company. Diabetes plagues much of the Gulf region, and the Gulf Program for Diabetes Control has been formed in response. The Synchrotron-light for Experimental Science and Applications [SESAME] is an example of what is needed more in the Middle East. These should serve as a stepping stone for the development of more forums for regional and international collaboration.

Ghubash: To my knowledge, there is no cooperation among Arab countries at all. But neither are there statistics to base my answer on.

el Feki: Very limited. There is no cooperation whatsoever. Some students from the Gulf states come to Egypt or to Jordan or to Lebanon to study, but there is no scientific link as such. Or it's at a level to be observed. Sometimes the Arab League is trying to do it. As an example, there is a common nuclear organisation for the Arab countries. But still this is a repeated effort, and there are no fresh ideas to help in that regard. The self-determination, the rulers' goodwill, to go through scientific research field is very important and essential. Everything in our part of the world comes from political decision – sometimes an aberrant political decision. Unless you are the leaders of the country – and I think the president of Egypt [Abdel Fattah el-Sisi] is trying to do that now, sometimes, to create results. You have to try.

Do you see the countries of the region using science diplomacy to improve engagement in science or science policy?

Shihab-Eldin: In the Arab world, where the consequences of civil and regional conflict are prevalent, science diplomacy can be an extremely

PROFILES

Adnan Shihab-Eldin was appointed Director General of the Kuwait Foundation for the Advancement of Sciences in 2011. He previously served as Acting Secretary General and Director of the Research Division of the Organization of the Petroleum Exporting Countries (OPEC); the Director of the Division for Africa, Asia & Far East at the International Atomic Energy Agency (IAEA), Vice-Rector for Academic Affairs of Kuwait University, Director General of the Kuwait Institute of Scientific Research, and Director of the UNESCO, Cairo Office.

Rafia Ghubash, a psychiatrist and epidemiologist from the United Arab Emirates, serves as president of the Arab Network for Women, Science and Technology, which is dedicated to attracting more women into science and helping them attain leadership positions. She previously served as president of the Arabian Gulf University in Bahrain from 2000 to 2009 and as dean of the Faculty of Medicine and Health Services at United Arab Emirates University.

Mostafa el Feki was appointed director of the Bibliotheca Alexandrina in May 2017 by Egyptian President Abdel Fatah al-Sisi. An influential political scholar and writer, el Feki has served as Egypt's ambassador to Austria as president of the British University in Egypt from 2005 to 2008. He is also the head of the Egyptian Ministry of Foreign Affairs Diplomatic Studies Institute.

powerful tool for building bridges between nations. The development of national science organization to fund, promote and support the inclusion of STI and raise cooperation and collaboration among countries regionally and internationally, was pioneered in Kuwait in the 60s and 70s. Kuwait proposed in 1976 the establishment of an endowment for the advancement of inter-Arab cooperation in R&D and STI. Unfortunately, the political climate has not allowed such proposals to materialize. Through establishment of institutions like KFAS, regional and international collaborations are being made possible. This has led to the establishment of similar organisations in the Gulf region for promoting research for national development, and to enhance dialogue and cooperation, such as the Qatar Foundation, MASDAR in the UAE, and KACST and KAPSARC in Saudi Arabia. We can certainly make a more concerted effort to create channels for

science diplomacy, which is not only essential to regional STI development, but more importantly to the promotion of regional peace and stability.

Ghubash: Let me share with you this article which answers the question: "Science Diplomacy in Arab Countries: The Need for a Paradigm Shift" [link: www.bit.do/SciDipShift] [by Nart Dohjoka, Cathleen A. Campbell and Brenna Hill, Science Diplomacy, 17 March 2017]: "...science alone cannot solve the many political, security, and economic problems that Arab countries face today. However, science diplomacy has an important role to play in addressing the health, environmental, energy, water, and food challenges that contribute to regional instability. These are shared problems that transcend national borders, and solving them will require collaboration."

el Feki: Maybe only in the field of technical aid. Among countries of our region, no, there is not much [science diplomacy], but maybe by

exchanging visiting professors and the talented scientists. But we don't have much more. We are looking forward to activate that, and I hope the Bibliotheca Alexandrina will be able to play a role in that field in particular.

What policies or programmes does your organisation offer to support young people and women, and for building international cooperation?

Shihab-Eldin: For the past 40 years, KFAS has embedded and strengthened the presence of STI within the various domains of Kuwait society, promoting STI through three main stakeholders: the society at large, especially the youth; the research community; and the private sector. Programmes and initiatives have been developed to engage these stakeholders, such as the support through funding of research, dissemination of resources for enhancing science education, support for advancing the development

“Whenever you encourage scientific research in the other countries, it will help to have an impact on poverty. Poverty is like a time-bomb everywhere. And reducing poverty will defuse terrorism.”

Mostafa el Feki

of the private sector through STI training and funding, and international partnerships to foster these initiatives. KFAS has also established centres that have focused on the promotion and advocacy of science, technology and innovation, where opportunities are provided for more engagement

and collaborations in STI initiatives, especially for the youth. The Scientific Center of Kuwait, one of KFAS's centres, provides an entertainment and educational platform for children and their families to engage in science and math. Another KFAS centre, the Sabah Al-Ahmed Center for the Giftedness and Creativity, allows young inventors to enhance their innovative and creative minds and foster their inventions into potential commercial applications.

Ghubash: When we established the Arab Network for Women, Science and Technology we did our best to find a way to help the young female graduates from different Arab countries to find opportunities in some of the good centres, but we faced many limitations and we could not progress any further. This could have had a good outcome if I had received support from different organisations that could help. Leaders need to do more to promote their value and credibility to support women in the field of science and technology.

el Feki: Yes, this is the main target we are trying to start. We want the Bibliotheca Alexandrina to be a centre of attraction for new generations. The president – when he visited, he told me for we should concentrate on the young generation, that the Bibliotheca should be a centre of scientific research and arts and literature, for national heritage, for joint thinking for the future, for brainstorming sessions. And we have centres in all of these branches. We are concentrating on arts, and science, and literature, and all sides of culture in general, young people and old, women and men. But we have a special concentration on the young generation. ■

Learn more about the 2017 KFAS conference, “Women Leaders in Science, Technology and Engineering”: <http://bit.ly/2FZS5Nz>




Mostafa el Feki



SCIENCE IN THE ARAB REGION

A SURGE OF ENERGY IN THE ARAB REGION

The countries of the Middle East and North Africa have a history and reputation as fossil fuel giants. But a region-wide shift is driving more research into solar and wind power.

 by Sean Treacy

Farouk El-Baz can remember, as a child in the 1940s, seeing windmills along the coast in Northern Egypt that generated enough energy to pump water from wells.

They were small, then – short, squat structures with slow-turning, wooden blades – and they were meant only to serve the local community. “We’d go to Alexandria and see all of them, and I’d ask my older brother, ‘What’s these things?’” said El-Baz, who was elected a TWAS Fellow in 1985. “It was a wind energy mill used to pump water for the well.”

In the ensuing years, he would continue to see them whenever he visited the area west of Alexandria. Today, though, they’re all gone. As soon as oil became a major resource in Egypt, the need for local wind energy died out, and wind energy began to seem like a thing of the past.

“Rather than the nice quiet mills, now we’ve got these noisy things emitting a lot of smoke into the atmosphere,” El-Baz said. “They thought of that as progress and it really isn’t. It’s reverting to mediocrity.”

Fossil fuels are central to the global identity of the Arab Region in the Middle East and North Africa. The region is a major source of oil, and it is oil that has built much of the region’s wealth and shaped its innovation culture. Yet the region could just as easily be a source of renewable energy, with vast desert landscapes that have rich potential as a home for solar energy plants, and long breezy coastlines that could be lined with wind turbines. Some researchers and policymakers are looking for creative ways to seize this potential – and some believe the effort is long overdue.

El-Baz, a remote sensing researcher who is focused on climate change and environmental

science, makes such a case. Interest in improving the environmental sustainability in the Arab region began about 20 years ago, he said. It seemed obvious to many Arab states that they were far behind in green energy, when they should be leaders.

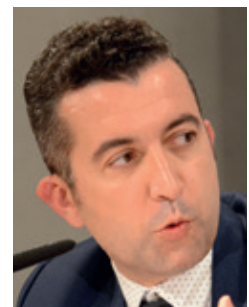
“It’s better to collect energy locally, with plants that they have developed,” said El-Baz. “That idea has caught the attention of countries across North Africa [and the Middle East].”

GREEN ENERGY IN THE DESERTS

The Middle East and North Africa, which make up what TWAS calls the Arab Region, is home to over 300 million people. It includes the world’s wealthiest nation per capita, Qatar, as well as some states that in recent years have faced chronic conflicts and unrest, such as Syria, Libya and Iraq. How rich is the potential? If the entire Sahara desert were covered with solar panels, it would produce 1.3 million terrawatts per hour.

The Middle East and North Africa (MENA) “region has more potential for solar radiation, more exposure to solar radiation, than any other part of the world,” said Jauad El Kharraz, a Moroccan water management scientist and

▼ From left: Farouk El-Baz; Jauad El Kharraz.



The Dead Sea Photovoltaic Power Generating Plant in Jericho, Palestine. [Photo: TrickyH/Wikimedia Commons, CC BY 4.0]



◀ An image taken from "A Pilgrimage to the Temples and Tombs of Egypt, Nubia and Palestine in 1845-6". [Credit: The British Library]

Head of Research at MEDRC Water Research, who is currently working on a solar-powered desalination project in Oman."

Yet still, some nations are undertaking serious renewable energy projects that could support people there for decades to come.

The global consulting firm Ernst & Young, in its latest Cleantech Survey Report for MENA, ranked Saudi Arabia, United Arab Emirates (UAE), Morocco and Jordan as having the greatest potential for renewable energy investment in the region. "The opportunities to provide affordable and secure low-carbon energy are continuously expanding," the report said.

And in a recent blog post, General Electric (GE) executive Hani Majzoub, head of the company's power conversion sales for renewables across the MENA region, called 2014 "a breakthrough year for solar in the

Middle East," with 30 projects receiving contracts, including 12 new solar sites in Jordan alone.

Perhaps the biggest solar energy boom is taking place in the UAE, which has committed billions of dollars in new clean energy projects over the last four years. The UAE will host what's expected to be the Middle East's largest solar project: Mohammed bin Rashid Al Maktoum Solar Park, in the desert 30 miles [48 km] south



“ We have a huge amount of water in the sea and desalination allows us to get fresh water from it. ”

Jauad El Kharraz





▲ Ain Beni Mathar Integrated Combined Cycle Thermo-Solar Power Plant in northeastern Morocco. [Photo: Dana Smillie/World Bank]

◀ Workers clean solar panels at Ain Beni Mathar Integrated Combined Cycle Thermo-Solar Power Plant in northeastern Morocco. [Photo: Dana Smillie/World Bank]

of Dubai. By 2030 the park should provide 3,000 megawatts – enough to power 50,000 homes and offset over 200,000 tonnes of emissions each year. A large majority of UAE’s power will come from natural gas. But solar will be second, at roughly 15%, followed by coal and nuclear. The plan is to eventually remove oil as an energy source entirely.

At the other end of the region, 6,000 kilometres west in the deserts of Morocco, the Quarzazate solar complex is being developed to provide 2,000 megawatts, and is already partially connected to Morocco’s power grid. It is being built in response to climate change and Morocco’s expensive fossil fuel imports.

Morocco is not an oil-rich nation – according to the World Bank, it imports more than 91%

of its energy resources from other countries. But energy demand is rising quickly, driven by economic growth and a population boom. Morocco has pledged to draw 42% of its power from renewable energy sources by 2020, and its efforts are being supported by loans and credit backing from international agencies such as the World Bank and the African Development Bank.

A PRESSING NEED CREATES NEW IDEAS

To accommodate these and other plans, some innovative work has taken place, finding new uses for renewable technology while also using new methods for generating that power.

Demand is growing. Saudi Arabia opened bids this year for its first solar power plant that will



pour energy into its grid. Kuwait is planning to put \$1.2 billion into a solar-power plant as part of an effort to generate 15% of its energy from renewables by 2030. In 2014, teachers and students at 25 public schools started receiving power from new solar panels that replaced diesel generators. Even Iraq has explored attracting foreign investors for the creation of three small solar energy projects and a wind energy project.

The United Nations Development Programme has been helping to guide many of these countries toward a more sustainable, greener system in accordance with the UN Sustainable Development Goals.

One innovation developed by researchers in the UAE was a new kind of solar collector that can be attached to the sides of walls like wallpaper. Normally, a solar panel would be a rigidly flat surface attached to a metal base that would move to follow the sun over the course of the day. But such panels are heavy and cumbersome, and expensive to transport

and install. So scientists developed a pliable solar energy collector, less than an inch thick, that can be rolled up and even placed on the walls of buildings. It cuts down dramatically on the cost and unwieldy qualities of the solar panels.

“It took them USD15 million to develop it, but it is certainly well worth it,” remarked El-Baz. “It’s in practice around the United Arab Emirates [UAE] and Egypt is looking at it, trying to see if they can produce it.”

WINDS OF CHANGE

The emphasis regionwide is mostly on solar energy, though there are some wind projects. Wind projects have found success in the UAE, Jordan and Morocco, but they’ve struggled to receive a strong push in Egypt and Saudi Arabia. And in Tunisia, researchers are exploring completely new ways to use wind energy, including a bladeless device inspired by and emulating ancient sailboats that used an aerodynamic bowl-shaped sail to capture more



▲ Tunisian engineer Anis Aouini, inventor, co-founder and chairman of Tyer Wind.

▼ A wind turbine farm in Tunisia. (Photo: Dana Smillie/World Bank)



► A Tunisian company called Tyer Wind is behind a new wind turbine design that uses flapping wings, inspired by the mechanics of hummingbirds. [Image: Tyer Wind]

energy than a traditional turbine. Another device developed by Tyer Wind uses flapping wings, inspired by the mechanics of hummingbirds. A Tunisian inventor, Anis Aouini, is behind both ideas; angel investors in Algeria and Pakistan are backing the Tyer Wind project.

Aouini, the inventor, co-founder and chairman of Tyer Wind, said the current shift toward green technology is a good opportunity for Arab countries without oil reserves, like Tunisia, to flex their innovative might. He anticipates that renewable energy will enter the private sector in Tunisia in two to three years.

"We have not had a good experience in recent history in innovation in developing countries in general," Aouini said. "So it's a good opportunity for us to demonstrate we are able to develop new technology in Tunisia, manufacture it in Tunisia and commission it in Tunisia. It's also a way to advance a new economic engine based on green technology. I think this is our future."

Renewable energy is also being applied in the Arab Region to assist other pressing problems, such as water scarcity. It's an urgent issue for countries such as Jordan, which has roughly 1.4 million refugees displaced from the conflict in Syria, and Palestine, which has suffered its own long conflict.

Desalination is the process of turning undrinkable salty seawater into drinkable fresh water.

El Kharraz, one of four international experts featured in a TWAS roundtable on science and science diplomacy held in Trieste, Italy, said desalination will likely be necessary to provide enough water to people in this part of the world. [see page 18]

But the process consumes a lot of energy. Oil-rich countries can afford it. Those short on oil must turn to another possibility: solar power.

"We should find a balance between demand and supply. Most countries are trying to control demand, but we want in parallel to focus also on the supply," said El Kharraz. "We have a huge amount of water in the sea and desalination allows us to get fresh water from it.

MEDRC is an international nonprofit organization in Oman created 20 years ago. Since its creation, MEDRC has funded over



“It’s a good opportunity for us to demonstrate we are able to develop new technology in Tunisia, manufacture it in Tunisia and commission it in Tunisia.”

Anis Aouini, founder and chairman of Saphon Energy

125 projects. Most deal with desalination technology, the cost of the energy for it, and how to minimize any negative effect on the environment.

El-Baz wants researchers, policymakers and the public all to push for more ambitious energy plans like these. Taking advantage of the region’s massive desert space could open up opportunities to sell power to other parts of the world.

“So,” El-Baz said, “maybe they can sell the ideas or the energy to places that don’t even have a speck of oil.”





NURTURING YOUNG TALENT IN KUWAIT

To develop a culture of innovation, the Sabah Al Ahmad Center for Giftedness and Creativity gives special attention to Kuwait's top students. The goal: a bright future for all.

 by Cristina Serra

Ibrahim Al Khashti is remarkably bright young man with an ambitious vision for his future: Born in 2005, he aims to become a surgeon, or perhaps a clinical project manager.

His potential was recognized early – when he was just 9 – by the Sabah Al Ahmad Center for Giftedness and Creativity (SACGC), an affiliate of the Kuwait Foundation for the Advancement of Sciences (KFAS).

The centre offers a selected elite of Kuwaiti youngsters aged 11-18 – or even younger – the opportunity to follow a full-immersion programme, with dynamic training to sharpen problem-solving abilities, increase decision-making and communication skills, and develop their minds.

“I’m very optimistic and I hold great expectations for my future,” Ibrahim said, showing a strong and positive feeling towards his position as an adult in Kuwait’s society. Attending SACGC, in fact, provides the unique chance to shape not only one’s future but the nation’s as well, under close guidance of top experts in education.

Under SACGC’s guidance, “gifted students receive intensive training,” explained Dr. Abdullah Alsauid, a manager in the giftedness department at the Center. “Here they are encouraged to test their thoughts and transform them into tangible science and innovations.”

SACGC has developed an integrated system to detect young talented minds, based on internal standards as well as international

criteria. Merit comes first, because this young elite is seen as the foundation for future development.

“The Gifted Programme’s ultimate goal is to build up the community of future scientists,” remarked Alsauid, who acts as SACGC specialist in gifted and talented education. “The programme takes the students to university level, trying to anticipate their potential role in the Kuwaiti Society in the area of industry, entrepreneurship, politics and other fields.”

The selection phase at SACGC flows through a collaborative agreement with the Ministry of Education, which drafts a list of students who achieve 90% and above in science and mathematics and 95% in general educational attainment at fifth grade. Students chosen for the programme enroll as sixth graders.

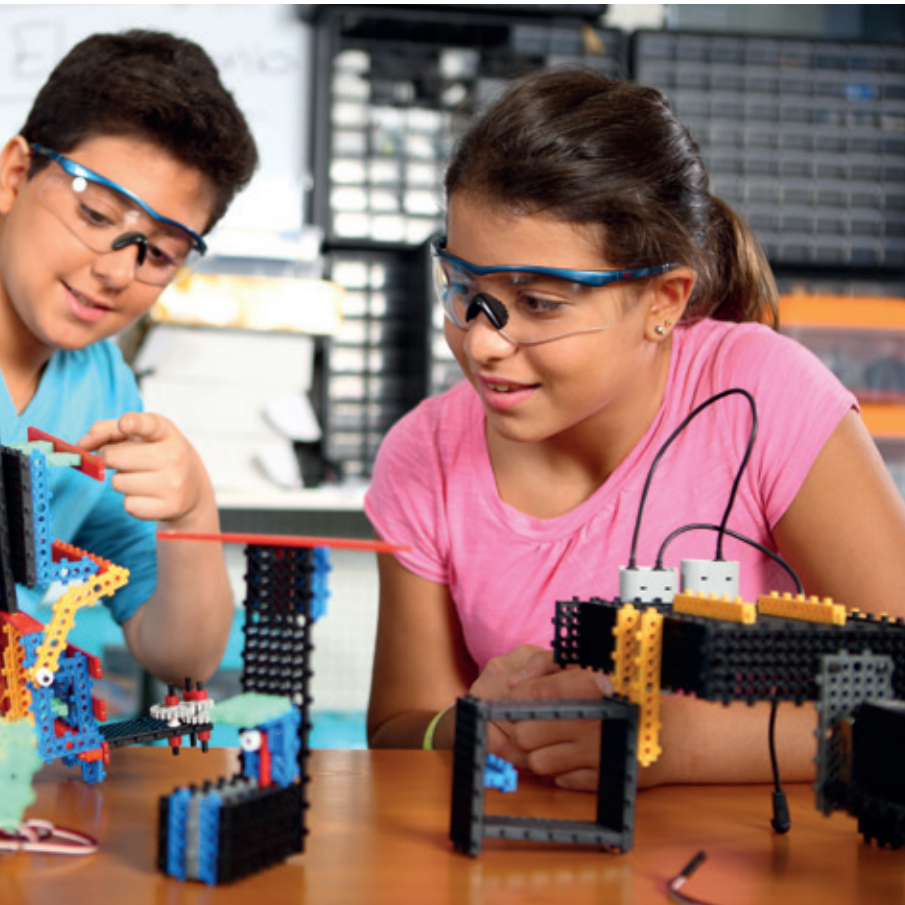
The idea of a center for gifted students was conceived in 1999, when KFAS established the Kuwait Office for Inventor Supports to encourage inventors to develop, innovate and protect their intellectual property.

SACGC was established in May 2010 by initiative of His Highness the Amir Sheikh Sabah Al-Ahmad Al-Sabah, Chairman of KFAS. It supports the goals identified in Kuwait’s 2030 Vision and Strategic Plan.

Students enrolled at SACGC – about 80-90 each year – continue to live with their parents. During the day they follow intensive curricula planned by the Ministry of Education, learning to develop critical and creative thinking, problem-solving abilities, exploration and



▲ The Sabah Al Ahmad Center for Giftedness and Creativity (SACGC), an affiliate of the Kuwait Foundation for the Advancement of Sciences (KFAS), offers elite Kuwaiti students a programme to develop problem-solving abilities. [Photo provided]



decision-making skills. Morning classes include science, mathematics, computers, Arabic and English, and are enriched with other scientific courses and field trips.

During evening classes, students follow applied science workshops, and receive a varied training in activities such as ceramics art, robotics, and 3-D printing. They are also assisted by sociologists and psychiatrists skilled in gifted students' education who improve their skills, communication techniques and self-confidence.

Under a 2015 agreement with the International Technology and Engineering Educators Association agreement, 172 students in grades 6, 7, 8, and 9 received a special programme in science and mathematics. And the same time, 60 teachers received training in how to make the programme a reality. In addition, there are special programmes with prestigious US research centres such as Purdue University and Johns Hopkins University.

The centre's success is evident in the steady increase in the number of students: 15 in 2012, 80 in 2016 and 305 today – 138 boys and 167 girls.

Even at a young age, students are innovating. The Invention Department, managed by Abdullah AlJadaan, sponsors initiators and innovators at the centre – and they have won patents for their inventions. In 2015, SACGC evaluated 137 ideas for potential new inventions.

Abdulridha Al Saffar, for example, has devised a subsurface irrigation system for farms and sport fields. The system, now patented, uses a complex network of pipes and channels ensuring that 90% of water in a pipeline is used for irrigation.

Other examples of excellence: a surgical needle-holder invented by Hassan Al-Shammri, which helps surgeons to move the needle in narrow areas; the "bee house" devised by Fahad Al-Azmi, which uses smart architecture to protect bees from high temperatures; and a "thermal breathing bed", a cradle invented by Sulalman Al-Khattat, mimicking the mother's breathing and body temperature while playing music to calm the baby.

“We seek to create a generation capable of bringing advancement in society and a brighter future to Kuwait.”

Abdullah Alsauid, Sabah Al Ahmad Center for Giftedness and Creativity

“Our students are able to represent Kuwait in global events. Many of them won universal prizes in Smart Brain Competitions, and represented SACGC, KFAS and the State of Kuwait in events abroad,” concluded Alsauid. “We seek to create a generation capable of bringing advancement in society and a brighter future to Kuwait.”



MANAGING STRESS IN THE MEDITERRANEAN

The Mediterranean Basin provides life-sustaining resources for a half-billion people. But as stresses rise, science diplomacy is essential, experts said at Trieste Next.

 by Cristina Serra

The Mediterranean Sea was a cradle of human civilization, and across the millennia its cultures have produced a wealth of commerce, art and scientific discovery. But today it is a stage for climate change, environmental decline, and a vast migration.

How can optimum health be restored? According to an international panel of researchers that TWAS convened for the annual Trieste Next festival, science diplomacy can be a powerful tool: Nations bordering the Mediterranean should partner in addressing critical challenges.

“The Mediterranean region faces environmental, economic, political and social challenges, calling for wider cooperation and coordination,” said Jauad El Kharraz, a Moroccan who heads research at the Middle East Desalination Research Center [MEDRC] in Oman.

“Water management is a matter of concern that touches everyone: economists, politicians, scientists and all of us in the audience,” said another panelist, TWAS Fellow Thameur Chaibi.

▼ From left: Jauad El Kharraz, of MEDRC in Oman, and Thameur Chaibi, of INRGREF in Tunisia.



Chaibi is research director and professor at the National Research Institute for Rural Engineering, Water, and Forestry [INRGREF] in Ariana, Tunisia. The message was underscored by others on a TWAS roundtable at Trieste Next, held 21–23 September.

Other panelists were: Tuğba Evrim Maden, a water policy expert from the Turkish Water Institute [SUEN], and Nadia Pinardi, a professor in the department of physics and astronomy at the University of Bologna, Italy. Both Maden and Kharraz are alumni of TWAS science diplomacy training programmes.

Trieste Next is an international science event held annually in Trieste, Italy, the headquarters of TWAS and a capital of European science. The 2017 festival was called “A sea of science”. TWAS organized the panel “Science diplomacy: a bridge over troubled waters” for the opening day.

“We recognize the complexity of the Mediterranean culture, and the pressures we are putting on this resource,” TWAS Executive Director Romain Murenzi said in his opening remarks. “International cooperation is vitally important, and the scientific institutions of Trieste are the centre of amazing international networks.”

Indeed, from Turkey to the Spanish-Moroccan Strait of Gibraltar, the Mediterranean Sea is a system of profound complexity.

Northern Africa is defined by its aridity, but the challenge varies from nation to nation, Chaibi said. While Tunisia and Algeria have stronger water resources, groundwater in

▼ Satellite image of the Mediterranean Sea and the lands that surround it. [Photo: NASA]





▲ Turkish water policy expert Tuğba Evrim Maden (top) and Nadia Pinardi, a professor of oceanography at the University of Bologna, Italy.

Morocco is decreasing. Some analysts say Egypt faces severe freshwater shortages by 2025.

But across the region, demand for water will greatly increase in the decades ahead due to the rapid pace of population growth. Desalination and wastewater reuse seem effective approaches, but both have constraints.

“Desalination should be introduced when it is the only possible alternative to produce fresh water,” Chaibi explained. “Its cost is still high mainly for the countries with low potential in energy resources and requires adjustments that cause environmental, economic and social downsides.”

When will this situation become critical? “It’s already critical,” Chaibi warned. “It can become worse if we do not manage it properly.”

In the last 20 years, the Mediterranean Sea with its biodiversity has been a theatre for research and conservation initiatives. Scientists have developed monitoring systems that provide daily overviews and big data on the health of the Mediterranean, as well as of other oceans.

“We have the technologies to make oceans part of the global issue of forecasting for sustainable development, and the opportunity to create new jobs for future generations, developing a new professional community that

“Water management is a matter of concern that touches everyone: economists, politicians, scientists and all of us in the audience.”

TWAS Fellow Thameur Chaibi of Tunisia

can exploit the sea’s potential with little harm,” said Nadia Pinardi, a professor of oceanography at Bologna University.

Pinardi is a driving force behind “operational oceanography”, the long-term and real-time monitoring and forecasting of marine parameters followed by interpretation and dissemination of the data.

“Operational oceanography provides precise forecasts, accurate descriptions of the state of the seas and oceans, can help to prevent damages from oil spills and helps ships to find the safest route,” Pinardi observed. Taken together, such data potentially lead “to more efficient conservation actions.”

With rivers, the situation is more complex. Rivers cross different countries causing friction over the right to use the water. In the Middle East, more than 60% of water is transboundary.

Disputes over transboundary waters among Turkey, Syria and Iraq, arising from sharing the Euphrates-Tigris basin, started when the construction of major dams in the 1960s raised regional tensions. Maden said the nations worked on and off for many years to solve the tensions. “Then, unfortunately, in 2011 Syria’s war began,” she said, “and all these initiatives were postponed.”

Some bilateral and multilateral North-South cooperation programmes are already under way, including PRIMA – Partnership on Research and Innovation in the Mediterranean Area, a pioneering EU-funded project among 19 countries focused on water and food security. With time, more EU and non-EU participants are expected to join the initiative. ■





A VISION FOR PROGRESS IN EYE CARE

The Nadi Al Bassar North African Center for Sight in Tunisia has emerged as a model institute for medical care and research in the developing world.

 by Cristina Serra

In the middle of the 20th century, two eye diseases were imposing a terrible toll on the health of Tunisia, across the Maghreb region, and through much of Africa: cataracts and trachoma. Both can lead to blindness – and both are preventable.

In the early 1950s, Ridha Mabrouk was a young ophthalmologist, Tunisian by birth and educated in France. And as he worked to help his patients, he came to an important realisation: These eye diseases caused vast human suffering, but they also slowed the development of the country.

His early dedication set in motion an extraordinary campaign to address preventable blindness in Tunisia, with an impact that now

▼ In 1980, at the first Colloque Afro Asiatique, Ridha Mabrouk, centre, presents guest of honour Abdus Salam (right) to Tunisian President Habib Bourguiba. Salam was the founder of the International Centre for Theoretical Physics and TWAS.

extends throughout Africa and to much of the world.

“My idea was how to render useful for the others what I had been learning,” Mabrouk said in a recent interview. “We decided to make good use of our capacities and make Tunisia independent in eye education and health.”

The first spark of inspiration led to a transformative movement: Mabrouk and his colleagues founded the Nadi Al Bassar North African Center for Sight in 1964, and its initial focus on cataracts and trachoma expanded to include pioneering work in corneal transplants and in providing care and education to support people with low-vision. Across the years, Mabrouk forged a strong connection with TWAS Founder Abdus Salam.

A MODEL FOR INTERNATIONAL COOPERATION

Not only has the Nadi Al Bassar Center helped to cure blindness and to empower people with low-vision, but it has nurtured far-reaching networks of care, teaching and scholar-exchange. Today it is a model for health care and research in the developing world, and a model as well for South-South cooperation.

Mabrouk personifies a remarkable story of commitment to public service. He earned his PhD in ophthalmology from Paris University in 1951. At the time, cataracts and trachoma were endemic in Tunisia and the Maghreb region of North Africa.

Cataracts are a clouding of the lens of the eye that often result from aging, but also from injuries or other eye diseases. Trachoma is a





“For all we have accomplished, we are indebted to many [...] Prevention remains a key step – and basic education is a must.”

Ridha Mabrouk

▲ Ridha Mabrouk with students at The Eye Institute for Low Vision at Hyderabad. (Photo provided)

▼ Ridha Mabrouk at the 1995 TWAS General Meeting in Nigeria.



bacterial infection that scars the inside of the eyelid; as the infection worsens, the eyelids curl inward so that the lashes scrape against the cornea, leading to severe and sometimes permanent reduction or loss of vision. These two afflictions are among the world’s leading causes of preventable blindness.

Even as he and his colleagues were developing medical interventions, Mabrouk also recognised the need for social change: People with vision problems were not handicapped, but rather “visual-deficient patients”. And they were not powerless – their conditions could be treated and improved.

In 1959, as the secretary-general of the Tunisian Ophthalmological Society, Mabrouk organised the first Maghrebian medical congress of ophthalmology after Tunisia was freed from French colonial rule. That event encouraged regional efforts, and the idea of an eye foundation was initiated.

A year later, Mabrouk took a post at the Tunisian government’s Eye Institute as a full-

time assistant; soon he became a department head and, in 1964, a faculty professor. That same year, Nadi Al Bassar was founded.

INNOVATION AS A NECESSITY

From the ‘60s to the ‘80s, Mabrouk and his colleagues introduced innovations that would prove transformative. They offered out-of-hospital, in-home care, launching an initiative that he dubbed “*najda*”, an Arabic word for ‘unexpected help’. They also set in motion programmes to train local professionals – ophthalmologists and technicians in the eye-care sector.

Challenges forced the team to innovate. “Cornea grafting became a necessity, because trachoma disease had left many people with cornea opacity,” Mabrouk explained. In the beginning, they had to import transparent corneas from abroad, and then NAB decided to establish an Eye Bank to attract cornea donors.

Central to its work are public awareness campaigns via local newspapers, radio and television – and even through drawing contests at schools. “We believe in efficient cooperation between the medical corporation, the medical personnel at the hospital and the community itself, including young children,” he explained.

As the capacity and expertise of Nadi Al Bassar grew, the team offered treatment and training in neighbouring countries such as Libya, Niger, Mauritania and Senegal. Mabrouk’s career brought him to global scientific capitals: Paris, Harvard and San Francisco, Stockholm, Barcelona, New York.

Now an established leader, the centre has been among the first supporters of Vision 2020: the right to sight. Vision 2020 is a programme launched in 1999 within the European Union’s Horizon 2020, with the aim of eliminating avoidable blindness by year 2020.


Today, aged 96, Mabrouk is still active, writing a book entitled “In the Service of Others” on the urgency of contributing to the right to sight. “For all we have accomplished, we are indebted to many,” he concludes. And, he adds: “Prevention remains a key step – and basic education is a must.” ■

Learn more: www.bit.do/twas-mabrouk-sight



A SOURCE OF LIGHT IN JORDAN

A new international high-tech laboratory in the Middle East, called SESAME, began work this year. Scientists from its member countries, through sharing this powerful tool, hope to advance science – and peace.

 by Sean Treacy

The Arab Region and many neighbouring countries have been struggling through a period of chronic instability and insecurity. But in Jordan, an international laboratory is providing a dazzlingly bright light for science throughout the region.

The official and long-anticipated opening of SESAME, Synchrotron-Light for Experimental Science and Applications in the Middle East, came on 16 May in Jordan. It is the region's first prominent international scientific research centre, run by a governing council of eight members – Cyprus, Egypt, the Islamic Republic of Iran, Israel, Jordan, Pakistan, the Palestinian Authority and Turkey.

SESAME researcher Gihan Kamel is an alumna of the AAAS-TWAS Science Diplomacy Summer Course, and she works on the centre's infrared beam. Kamel's involvement in SESAME began 12 years ago, in 2005, as Egypt's delegate in SESAME's Users Committee. After a few years, she became a staff member. She also organizes scientific meetings focused on the connections between science, society and industry, and she mentors and supports young women in science.

SESAME, she said in a recent interview, is a major example of science diplomacy in the global South. Though at the beginning, it was challenging to even bring representatives of the various governments together and to generate interest.

The main lessons she has learned at SESAME go well beyond science, Kamel said. "Neutrality, fairness, openness, changing perspectives

for the good of all, how to be a driving force not only on the national level but also on the international one – and mostly how to overcome all the negativity surrounding us in the region and to be a model for others to join."

SKEPTICISM AND OTHER OBSTACLES

The facility will enable visiting scientists, including university students and researchers, to participate in experiments on synchrotron radiation sources, analyse the data obtained and acquire and share scientific expertise and knowledge. They recently opened a call for proposals, and 55 were received from the Middle East and neighboring regions. But adding to this impressive achievement, the state-of-the-art laboratory overcame a decade of obstacles, including skepticism from both decision-makers and the public that its creation was even possible.

The laboratory generates high-powered beams of light from charged particles whirling through a large ring in its centre. This light is then used to conduct advanced research. SESAME is in the process of commissioning its powerful light beams, one by one. Several of them, some infrared and some x-ray, have already been approved, brought online, and are in use emitting light particles for experiments there. The infrared beam, which Kamel works on, can reveal the chemical properties of objects and is useful to, for example, analyze breast tissue to improve cancer diagnoses.

Work at SESAME will also explore the material

▼ The inside of the SESAME complex in Jordan as it was being prepared to begin work.
(Photo: SESAME)



sciences, physics, healthcare, agriculture and archaeology.

Just as important, the institute is a prominent example of science collaboration among countries that sometimes have strained political relationships, said Kamel. Yet the process to set SESAME up required difficult diplomacy to overcome this skepticism in the region.

The regional tensions are more sensitive and amplified than for most other parts of the world, Kamel said, because the political situations are more unstable, resources are lacking and opportunities are fewer. The countries are also under pressure to make leaps forward in lab technology to compel local talent to stay in their home countries rather than move abroad for better opportunities.

She traced back the inspiration for SESAME back to the work of TWAS founder Abdus Salam, arguing for more laboratories with advanced technology for research across all fields in the developed world.

"He pointed out that the Third World is – even if slowly – waking up to the realization that modern science and technology are the basic



▲ Gihan Kamel, SESAME researcher and alumna of the AAAS-TWAS Science Diplomacy Summer Course

To see a full list of countries that serve as SESAME members as well as observers, please visit: www.bit.do/SESAME-Info

“ [SESAME] levels out our beliefs and brings us together across our differences to a common destination for the benefit of all of us in the region. ” *Gihan Kamel*

parameters to distinguish the developing from the developed countries,” she said.

Researchers and decision-makers then drew inspiration from the success of the European Organization for Nuclear Research (CERN) and its Large Hadron Collider in Geneva, Switzerland. Though World War II was well over by the time CERN was built in 1954, the particle collider was part of a regional science enterprise that helped nations to experience success as partners after years as wartime enemies.

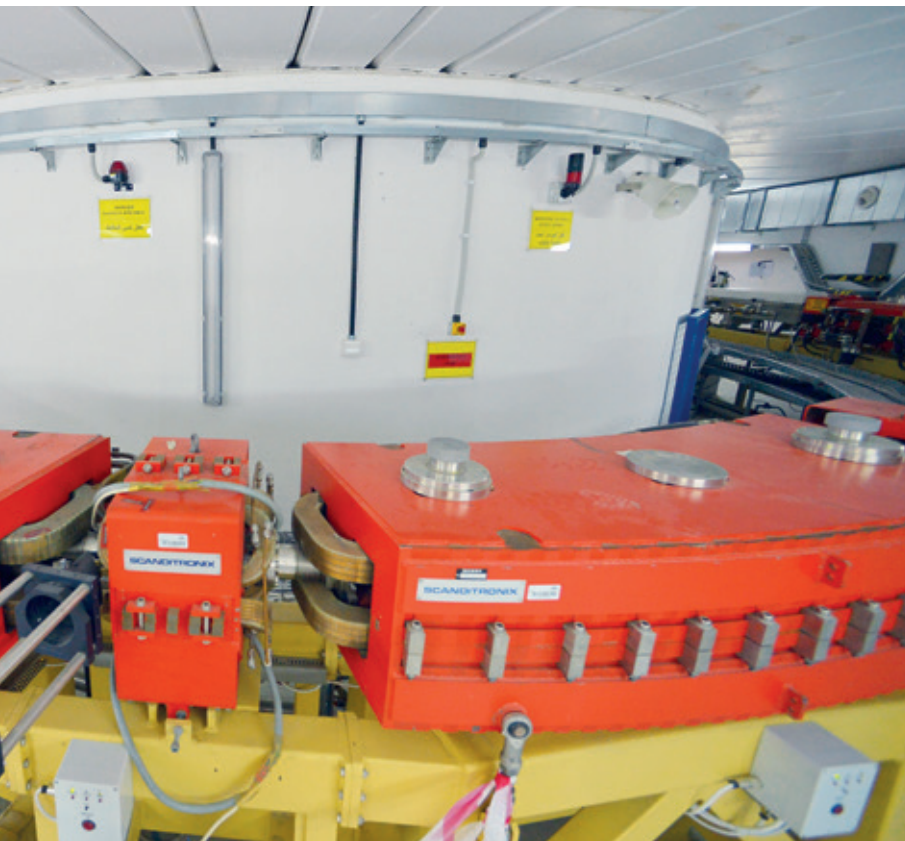
A MODEL FOR SCIENCE DIPLOMACY

Kamel believes projects like SESAME help create a more peaceful and equitable world by creating bonds between countries that might not be possible through conventional political means. This makes SESAME a model for science diplomacy in the region, bringing people together from various nationalities – including Israelis and Palestinians.

“In its essence, it levels out our beliefs and brings us together across our differences to a common destination for the benefit of all of us in the region,” she said. “SESAME is a reality that we live right now, and it’s become a role model of science diplomacy.”

Kamel also anticipates that, though she is currently the only woman staff scientist at SESAME, the existence of the institute in the region will open doors for more women using fellowships and grants.


“I strongly believe that SESAME will open the door for hundreds of them,” she said, “handing women a priceless gift to help them execute their goals without conflicting with their own traditions. It will also help them to serve their societies as much as their male colleagues.”





A VITAL FIELD FOR COOPERATION

At the University of Tlemcen in Algeria, studies in medical physics provide a laboratory not just for health care, but also for ethics, science-policy engagement and science diplomacy.

 by Mustapha Benmouna

Medical physics provides an opportunity for scientists throughout the world to collaborate fruitfully. It is an interdisciplinary domain where not only physicists and medical doctors are concerned, but also researchers from chemistry, biology, mathematics and many other fields. This means that progress in medical physics requires a collective contribution from experts in complementary fields joining in a common programme. The challenges are so big that the collaboration between scientists may not be sufficient, and close coordination with policymakers may be required.

As the world population increases, so does the need for more energy to sustain economic development and the growth of consumption in all kinds of goods. Progress in science and technology leads to a growing use of energy, and then to the dissemination of polluting agents into the atmosphere. These rapid changes put a heavy burden on society, including threats to public health. For example, cancer has grown at alarming rates in recent years. This situation provides incentives for medical physicists to join their efforts to develop new techniques via scientific research that could lead to efficient therapies.

Epidemiological studies relate the emergence of cancer to a variety of factors like heredity, abnormal exposure to ionizing radiation, contamination by chemical products, and unhealthy eating and drinking habits. These observations suggest the necessity for

medical physicists to put together a platform of exchanges where concerned scientists and policymakers can join to develop dedicated programmes for training and research.

The University of Tlemcen in Algeria [also known as Université Abou Bekr Belkaid Tlemcen] started a master's degree programme in medical physics in 2009, in response to a request expressed by the Ministry of Higher Education and Scientific Research. This programme was first meant to be a contribution to fill the gap between the urgent needs for medical physicists and the insufficient training capacity of Algerian universities. The Algerian government is giving a particular attention to the rising number of cases of cancer in recent years, and initiated an urgent plan to build and equip several hospitals with cancer treatment centres.

These centres will be disseminated throughout the country to meet the increasing demands of the population. This should reduce the burden on patients, who currently have to move far away from their homes to get adequate medical care. For a population of nearly 40 million, only eight such centres and a few private clinics are effectively operating at present. Ten others are under construction; five are already expected to be ready for patients within a year or less. One of these belongs to the university hospital complex at Tlemcen.

For the training programme, special agreements of cooperation were signed not



▲ Author Mustapha Benmouna surrounded by young colleagues at the University of Tlemcen in Algeria in 2017. [Photo: Fazil Dib, Faculty of Sciences, University of Tlemcen]

▼ Logo of the University of Tlemcen.





“ Nuclear medicine is a major theme of collaboration between scientists and policymakers who wish to promote peaceful uses of atomic energy. ”

only with Tlemcen University Hospital but also with that of Oran, a major city in Algeria, which is about 150 kilometres east of Tlemcen. The majority of our master’s students spend at least one semester working in hospital services such as the anti-cancer centre of Oran and nuclear medicine of Tlemcen, under the supervision of medical professors, qualified physicians and medical physicists. A requirement in the training programme is to write a special report on one of the major themes in applied medical physics and make an oral presentation before a committee of four experts in the field.

The training programme lasts four semesters, during which students are taught basic concepts of how to assist doctors in manipulating particle accelerators, to ensure good maintenance of electronic equipment, and to be responsible for protection from ionizing radiation. They also learn how to execute a medical doctor’s prescription for the treatment, implementing the proper prescribed doses, and thus how to fully understand the treatment procedure. Courses in ethics related to the specific duties of medical physicists are given, emphasizing the aspects related to adequate relationships with both the medical team and the patients. It is worth noting that the University of Tlemcen also offers a graduate programme leading to a doctorate diploma in medical physics.

Several members of the teaching team are medical doctors, working in nuclear medicine at the university hospital. Therefore, our students are informed by the working conditions in those services and specially trained to handle questions related to radioprotection and radiobiology and the risks of manipulating radioisotopes. Medical physics and nuclear medicine overlap in those domains, which enhances the need for a close collaboration among concerned scientists, and a strong relationship with policymakers to help them make sound judgments and decisions.

Nuclear medicine is a major theme of collaboration between scientists and policymakers who wish to promote peaceful uses of atomic energy. It can be an important focus for science diplomacy, too. For example, the production of radioisotopes necessary to run nuclear medicine services for diagnosis and treatment of cancer is more accessible to some countries than to others, which means that it may constitute an ideal domain of cross-border collaboration under the auspices of the International Agency for Atomic Energy. ▣

Mustapha Benmouna, from Algeria, was elected to TWAS in 1989. He is professor of physics at the University of Tlemcen in Algeria.



WORLD SCIENCE FORUM: SCIENCE FOR PEACE

 by Edward W. Lempinen and Sean Treacy

As the World Science Forum convened in Jordan, TWAS and IAP organised sessions on refugee scientists, food security and African STI.

Confronted by an array of global challenges – from stubborn poverty to climate change and mass migration – high-level science leaders and policymakers convened in Jordan for the 2017 World Science Forum. Meeting under the theme of “Science for Peace”, the Forum heard from prominent global figures working to address the challenges and advance sustainable development.

Among the speakers were Jordanian Prince El Hassan bin Talal; Hungarian President János Áder; Naledi Pandor, South African Minister for Science and Technology; Abdelhamid El-Zoheiry, president of the Euro-Mediterranean University in Slovenia; Keisuke Hanaki, former vice president for international affairs the Science Council of Japan; and Rush Holt, chief executive officer of the American Association for the Advancement of Science [AAAS].

“We believe that scientists and policymakers, working together, must help to lay the economic foundations for an improved quality of life for the world’s ever-increasing population,” said Princess Sumaya bint El Hassan, the president of the Royal Scientific Society of Jordan and chair of the



▲ Princess Sumaya bint El Hassan, the president of the Royal Scientific Society of Jordan and chair of the Forum.

Forum. “Our challenges are borderless, and so must be our mindset.”

The World Academy of Sciences [TWAS] and its associated organisation, the InterAcademy Partnership [IAP], had a significant presence at the Forum, with a range of sessions and presentations focused on challenges especially relevant to the developing world.

The forum ran from 7-11 November at the King Hussein Bin Talal Convention Centre at the Dead Sea in Jordan. Some 900 speakers from over 100 countries participated, with 3,000 people attending.

The Forum assessed challenges ranging from food production and security to sustainable energy and fighting global pandemics. It also explored a range of 21st century tools: artificial intelligence, science diplomacy and improved communication.

Also among the speakers was TWAS Executive Director Romain Murenzi, featured in special session on 8 November, “International Funding for STI in Africa: Help or Hindrance?”

TWAS and IAP – both Forum partners – helped to organise other sessions on avoiding the weaponisation of research; food and nutrition security; brain drain; and skills needed by young researchers to advance science diplomacy.

TWAS and UNESCO organised a panel discussion, “The Journey of Refugee Scientists”. A new TWAS documentary film on displaced scientists, “Science in Exile”, had its premiere screening at the Forum.

“We believe that the World Science Forum is a gathering of the highest importance for addressing the challenges confronting the world, both South and North,” Murenzi said. “By bringing together scientists and policymakers at the highest levels, and from all parts of the world, the influence of the Forum resonates globally.” ■

Learn more:
www.twas.org/article/science-peace-jordan

Read the World Science Forum declaration:
www.bit.do/WSF17_declaration

PEOPLE, PLACES & EVENTS

TYLER PRIZE TO JOSÉ SARUKHÁN

Mexican ecologist **José Sarukhán**, a 1991 TWAS Fellow, has received the 2017 Tyler Prize for Environmental Achievement for his scientific contributions to biological diversity. In the early 1990s, he was able to convince the then-president of Mexico to create a federal-level agency to inventory the biodiversity of Mexico, as well as monitor its conservation and sustainable use. This is how he co-founded CONABIO, Mexico's biodiversity agency that hosts the largest national biodiversity database in the world, with over 11.2 million specimens. For this and other scientific achievement, he is referred to as the founding father of ecological research in Mexico. Sarukhán's recent interest is citizen science. By making CONABIO's database publicly available, he has promoted direct participation and access to information of hundreds of thousands of people. Sarukhán joins other world-class researchers such as E.O. Wilson and Jane Goodall as Tyler Prize winners.

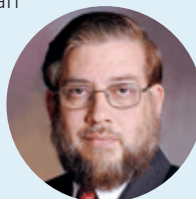


GADAGKAR ELECTED TO AMERICAN ACADEMY

TWAS Fellow **Raghavendra Gadagkar**, an ecologist and evolutionary biologist, has been elected as a foreign honorary member of the American Academy of Arts and Sciences [USA]. Gadagkar is a full professor at the Centre for Ecological Sciences and Centre for Contemporary Studies at the Indian Institute of Science in Bangalore. He

obtained his bachelor and master's degrees in zoology from Bangalore University, and his PhD in molecular biology from the Indian Institute of Science. He was elected to TWAS in 2000.

Gadagkar is an expert in cooperation among social insects: his observations of altruism in ants, bees and wasps have modified the common view of the relationships that shape the evolution of insects' social life. He has established an active school of research in the area of animal behaviour, ecology and evolution. He previously received a number of awards, including the TWAS Award in Biology [1999], the Shanthi Swarup Bhatnagar Prize, the B.M. Birla Science Prize, and B.P. Pal National Environment Fellowship on Biodiversity. Gadagkar served as president of the Indian National Science Academy from 2014 to 2016.



ABIDI APPOINTED AT LAHORE

Asad Abidi has been appointed the inaugural holder of the Abdus Salam Chair at the School of Science & Engineering at Lahore University of Management Sciences [LUMS], Lahore, Pakistan. The appointment was effective 1 January 2017. Abidi is a 2009 TWAS Fellow and a member of the US National Academy of Engineering. He is a distinguished chancellor's professor of electrical engineering at the University of California, Los



Angeles. A teacher of the sciences and engineering, his groundbreaking research has resulted in the development of single-chip radios, as well as in electronic devices and circuits that are major components of contemporary mobile devices. In 2008, he was awarded the IEEE Donald O. Pederson Award in Solid State Circuits.

MORÁN LÓPEZ TO LEAD MEXICAN ACADEMY

José Luis Morán-López is the new president of the Mexican Academy of Sciences [MAS]. The appointment began in July 2017, and will last until 2020. He follows previous president Jaime Urrutia Fucugauchi [2014-17], a 2004 TWAS Fellow. A native of Charcas, Mexico, Morán-López obtained his doctorate in physics from the Free University of Berlin, Germany, in 1977. Elected to TWAS in 1991, he was chosen as the Academy's treasurer in 2003, and was re-elected again in 2006, holding this position for two more years. He is the founding director of the San Luis Potosí Institute for Scientific and Technological Research [IPICT], where he is currently a professor. From 2012 to 2016 he served as the president of the Science Committee of the International Council for Science [ICSU] for Central America and the Caribbean. Morán-López is the recipient of many awards, including the Alexander von Humboldt Research Grant in Germany [1992] and the Marcos Moshinsky Medal [1995] from the Institute of Physics at the National Autonomous





PEOPLE, PLACES & EVENTS

University of Mexico [UNAM]. He obtained the Mexican National Award in Sciences and Arts [1996].

TWAS YOUNG AFFILIATE ATTENDS NOBEL LAUREATE MEETING

Victorien Tamègnon Dougnon, a 2016-20 TWAS Young Affiliate and a member of the recently established TWAS Young Affiliates Network [TYAN], was selected to participate in the 67th Lindau Nobel Laureate Meeting [June 2017] in Lindau, Germany. Dougnon, a native of Benin, is a lecturer in microbiology at the department of human biology, Polytechnic School of Abomey-Calavi [EPAC], University of Abomey-Calavi [UAC] in Cotonou, Benin. Dougnon holds bachelor's and master's degrees in biomedical sciences at EPAC and a PhD in environmental and health sciences at UAC. He is a researcher in applied microbiology and pharmacology of natural substances at UAC, where he set up a modern lab with a TWAS grant and the support of the rectorate of UAC. His scientific interests cover market gardening and the hygienic quality of foodstuffs; the application of microbiological techniques to the resolution of hygienic problems; and the exploration of Benin's flora useful for the treatment of infectious diseases. He has been appointed as American Society for Microbiology [ASM] Young Ambassador to Benin.



ENSHASSI WINS GOLD MEDAL

Adnan Enshassi, a distinguished professor of construction engineering and management from the Islamic

University of Gaza [IUG] in Palestine [West Bank and Gaza Strip], has been honoured with a gold medal and an honorary professor title by IUG.

Enshassi, elected to TWAS in 2015, received this award in recognition for his achievements in research development, community services, the high quality and quantity of his publications and his engagement in international relations for the last 20 years. His scientific interests include disaster management, green building and sustainability, safety in construction, productivity improvement, risk management and dispute avoidance. A member of the Palestinian Academy for Science and Technology, he was awarded the University Scientific Research Prize for Engineering Sciences from Palestine twice and he has received several grants and fellowships to universities in Germany, the US and France, among others. Enshassi has been a visiting professor in many universities in the US, Germany, Austria and the UK.



HIGHEST UZBEK HONOUR TO TWAS MEMBERS

Uzbek mathematician **Shavkat A. Ayupov**, a 2003 TWAS Fellow, has won the Uzbek Highest State Prize in the field of science and technology. The prize is awarded once every two years by the decree of the president of the Republic of Uzbekistan. Ayupov is the Director of the V.I. Romanovskiy Institute of Mathematics of the Uzbekistan Academy of Sciences in Tashkent. His research has covered a number

of fields in non associative algebra, operator algebras with applications in non-commutative and non-associative integration theory and in quantum probability theory. He has been a member of the Uzbekistan Academy of Sciences since 1995, and has won the Academy's Young Scientist Prize [1977], the Uzbek Comsolol Youth Prize in Science [1983] and the Soviet Union's All-Union Youth Prize in Science and Technology [1986]. Three former TWAS Young Affiliates from Uzbekistan, all mathematicians, have also received the prize. They are: Karimbergen Kudaybergenov, Bakhrom A. Omirov and Utkir A. Rozikov.



IN MEMORIAM

Syed Qasim Mehdi, a world-class molecular biologist from Pakistan, passed away in Lahore in September 2016. Mehdi, a 1998 TWAS Fellow, was a pioneering advocate of human medical and evolutionary genetics research and bioethics in Pakistan.



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

TWAS was founded in 1983 by a distinguished group of scientists from the developing world, under the leadership of Abdus Salam, the Pakistani physicist and Nobel Prize winner. Today, TWAS has about 1,190 elected Fellows from 96 countries; 15 of them are Nobel laureates. It is based in Trieste, Italy, on the campus of the **Abdus Salam International Centre for Theoretical Physics [ICTP]**.

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

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

TWAS and its partners offer over 490 fellowships per year to scientists in the developing world for PhD studies and post-doctoral research. TWAS prizes and awards are among the most prestigious given for scientific work in the developing world. The Academy distributes more than USD1 million in research grants every year to individual scientists and research groups. It supports

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

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

The Organization for Women in Science for the Developing World [OWSD]. At its founding in 1989, OWSD was the first international forum uniting women scientists from the developing and developed worlds. Today, OWSD has more than 6,000 members. Their objective is to strengthen the role of women in the development process and promote their representation in scientific and technological leadership.

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

TWAS receives core funding from the Italian Ministry of Foreign Affairs and International Cooperation, and key programmatic funding from the Swedish International Development Cooperation Agency [Sida]. It is a programme unit of UNESCO.

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