TWAS 25TH ANNIVERSARY

1

YEAR 2008
VOL.20 NO.1

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TWAS newsletter

NEWSLETTER OF THE ACADEMY OF SCIENCES FOR THE DEVELOPING WORLD

Published with the support of the Kuwait Foundation for the Advancement of Sciences

ADDITIONAL FUNDING; DISCUSSIONS WITH THE STEERING COMMITTEE; PLANS FOR THE ACADEMY'S 25TH ANNIVERSARY. TWAS AND ITS ASSOCIATED INSTITUTIONS HAVE RECENTLY MOVED AHEAD ON THREE FRONTS. THE FOLLOWING BRIEF ARTICLES OUTLINE THE PROGRESS THAT HAS BEEN MADE.

FUNDING IAMP

In December 2007, the Italian parliament signed a law granting the Trieste-based InterAcademy Medical Panel (IAMP) €500,000 (US$750,000) a year. The funds will be used to cover IAMP's operational expenses and expand its programmatic activities. The law specifies that the money should be added to the annual budget of TWAS for the purpose of funding IAMP on a permanent basis.

"This is great news", says Guy de Thé, co-chair of the IAMP executive committee and a member of the Académie de Médicine, Institut de France. *"We have been seeking core funding for IAMP ever since the organization's inception in 2000. Until now, we have been able to operate effectively thanks largely to the help of TWAS, which also receives its core funding from the Italian government."*

Progress on Three Fronts

de Thé notes that IAMP's participation in the second edition of the Disease Control Priorities Project (DCPP2), an initiative funded by the Bill and Melinda Gates Foundation and organized by the US National Institutes of Health's (NIH) Fogerty International Center, the World Bank, the World Health Organization and the Population Reference Bureau, helped to raise IAMP's international profile. This was especially true during the official launch of DCPP2's publications in Beijing, an event that was held in conjunction with IAMP's 'Global Forum' in April 2006 (see TWAS Newsletter, *vol. 18, no. 2, pp. 54-59).*

"The Italian government's generosity will now provide a secure and stable source of funding that should help us advance our agenda much more rapidly", says de Thé.

"The money", adds Anthony Mbewu, co-chair of the IAMP executive committee and a member of the Academy of Sciences of South Africa, "is indeed welcome. One of the key criteria

CONTENTS

TWAS NEWSLETTER
Published quarterly with the support of the Kuwait Foundation for the Advancement of Sciences (KFAS) by TWAS, the academy of sciences for the developing world
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PRINTING
Stella Arti Grafiche, Trieste

that external funders and partners – foundations, aid agencies and research institutions – look for when providing grants or creating opportunities for collaboration are organizations with institutional capacity – that is, institutions that have well-recognized expert skills and sufficient resources to help leverage the support that is provided."

"IAMP has always had the skills", notes Mbewu. "Now, thanks to the generosity of the Italian government, we will have a strong resource base. That should make it easier for us to solicit external funding to implement and expand our agenda. It should also help us forge closer ties with international partners."

"In addition to the anticipated boost that it will give our fundraising efforts", Mbewu says, "the Italian government's annual contribution will help IAMP strengthen the secretariat and facilitate coordination among member academies."

IAMP's programmatic roadmap has been detailed in its strategic plan for 2008-2010. The plan calls for a research agenda that concentrates on the following issues:

- *Reducing perinatal and maternal mortality in poor countries.*
- *Improving the writing skills of young scientists and clinicians.*
- *Devising strategies for controlling rheumatic fever and rheumatic heart disease in developing countries.*

IAMP'S MISSION AND PURPOSE

The InterAcademy Medical Panel (IAMP), established in 2000 at the World Conference on Scientific Academies held in Tokyo, is an association of academies of medicine and medical sections of science academies, dedicated to improving the health of people worldwide. IAMP currently has 65 members. It focuses on building the capacity of its member institutions, particularly those in the developing world. It seeks to achieve its goals by:

- *Promoting health through research and education.*
- *Broadening capacity in health sciences and health professions.*
- *Providing independent, evidence-based advice on health-related science policy issues to governments, international organizations, private organizations and the public at large.*

- *Assessing healthcare quality in the developed and developing world.*
- *Curbing the incidence of infectious disease.*
- *Building an international mother-child research network.*

"IAMP represents a global network comprised of prominent medical institutions", says de Thé. "The organization, moreover, concentrates on issues of health, which survey after survey show to be among the top issues for people both in the developed and developing world."

IAMP's membership, focus and resources all suggest that it has a bright future – one that can make a difference not just for the organization itself but for our global society", asserts de Thé. "That future has become even brighter now that IAMP has been placed on firm financial footing due to the benevolence of the Italian government."

"We are truly thankful", observes Mbewu, "for the Italian government's far-sighted generosity in funding IAMP, which is now poised to become a key player in efforts to promote global public health. We are determined to use the money in ways that make a real difference to the health of people worldwide and that cast a favourable light on both Italy and Trieste for the contributions that they are making to global well-being." ■

For additional information about IAMP, see www.iamp-online.org.

IAP-IAC MEMORANDUM

Ihe InterAcademy Panel on International Issues (IAP), a Trieste-based international scientific organization associated with TWAS, and the InterAcademy Council (IAC), headquartered in Amsterdam, have signed a memorandum of agreement calling for greater collaboration between the two organizations. The signing ceremony took place at the first-ever IAP-IAC joint session held in the IAC secretariat at the Royal Netherlands Academy of Arts and Sciences in Amsterdam, on 30 January 2008.

Specifically, the agreement stipulates that the IAP executive committee and IAC board will meet at least once a year to discuss issues of common concern. It also urges the organization to hold joint workshops and to participate jointly in such international fora as the World Economic Forum in Davos, Switzerland, and the Science and Technology in Society Forum in Kyoto. Joint fundraising and reports on critical issues related to science, technology and innovation will also be pursued.

IAP (www.interacademies.net), a global network of science academies currently consisting of 98 members, is dedicated to building the capacity of science academies to interact more effectively with their societies. IAC (www.interacademycouncil.net) publishes reports on scientific, technological and health issues related to today's global challenges, providing knowledge and advice to national governments and international organizations.

STEERING AHEAD

The TWAS Steering Committee held its annual meeting in Trieste on 25 January 2007. In attendance were committee members Barbara Bregato, Consigliere d'Ambasciata, *and Immacolata Pannone, expert, Scientific and Technological Cooperation, Italian Ministry of Foreign Affairs; Walter Erdelen, Assistant Director-General for Natural Sciences, UNESCO; and Edoardo Vesentini, past president,* Accademia Nazionale de Lincei. *Antonio Bartolini,* Consigliere d'Ambasciata, *Italian Ministry of Economy and Finance, and Mauro Massoni, Head of NGOs Office, General Directorate for Development Cooperation, Italian Ministry of Foreign Affairs, were also present as observers. Jacob Palis, president, and Mohamed Hassan, executive director, represented TWAS.*

The Steering Committee, first organized in 2006, is designed to keep TWAS's main benefactors – the Italian government and UNESCO – informed of the Academy's activities. It also has responsibility for overseeing and approving TWAS's annual budget.

Bregato, who chaired the meeting, opened the discussion by citing the Italian government's long-standing commitment to helping build scientific and technological capacity in developing countries as a means of improving the quality of life for less fortunate people. She also noted that the meeting provided an excellent opportunity to strengthen the relationship between TWAS and the Italian government.

Jacob Palis, president of TWAS, spoke about the accomplishments of the Academy over the course of 2007. He pointed to the Italian government's decision to fund IAMP on an annual basis; he cited the success of TWAS's 18th General Meeting that took place in Trieste in November; and he noted the growth of the TWAS endowment fund which now totals more than US$10 million.

Palis stated that the Italian government's contribution to IAMP reflected the growing strength and expanding mandate of the Trieste System. He observed that the most recent TWAS meeting, held in Trieste in November, featured a successful half-day session on research conducted by young scientists in the developing world. The event showcased the key role that TWAS is playing in nurturing the next generation of researchers in the South. The TWAS endowment fund, he added, which is comprised exclusively of contributions from developing countries, offers a clear indication of the value and support that countries in the developing world extend to TWAS. "We hope", Palis said, "that the endowment fund will eventually reach US$25 million. That would be sufficient to cover all of the Academy's oper-

ational expenses, allowing the Italian government's contributions to be used exclusively for programmatic activities."

Erdelen stated that relations between TWAS and UNESCO were strong but that he would like to see them grow even stronger in the future. He pointed to three areas where he thought progress could be quickly made – expanding the links between the TWAS and UNESCO websites, fostering greater participation of UNESCO member states in TWAS's 25th anniversary celebration, and working with UNESCO to foster closer ties between such UN agencies as the World Health Organization and TWAS and its associated organizations – the InterAcademy Panel (IAP), the InterAcademy Medical Panel (IAMP) and the Third World Organization for Women in Science (TWOWS).

Bregato also expressed her appreciation for the strong ties between TWAS and the Italian government. But she echoed the sentiments of Erdelen in noting that more could be done. Through projects such as 'Capacity Building in Environmental-Related Issues in the Field of Geo-Mining and Coastal Zone Management', sponsored by FORGEA International, a geo-mining company headquartered in Sardinia, she suggested that TWAS could help bring scientists from around the world together with colleagues from Italy in a true display of South-South and North-South cooperation.

"Efforts by TWAS to collaborate with other organizations in Italy", Bregato noted, "represent a way of creating synergy between the national and international scientific institutions located in Italy. At the same time, these interactions would help to forge valuable ties between Italy and the developing world." ■

CELEBRATING 25 YEARS

The officers of TWAS met in Trieste on 25 and 26 January 2008. Jacob Palis, president; C.N.R. Rao, immediate past president; D. Balusubramanian, secretary general; José Luis Móran López, treasurer, and Mohamed H.A. Hassan, executive director, were in attendance. Daniel Schaffer, public information officer, and Peter McGrath, acting programme officer, participated as observers. The main topic of discussion was the upcoming TWAS 19th General Meeting and 25th Anniversary Celebration, scheduled to take place in Mexico City from 10 to 13 November 2008.

"The 25th anniversary of TWAS", noted Palis, "will provide an excellent opportunity to examine the Academy's achievements over the past quarter century. The generosity of the Mexican government will ensure that this will be an exciting and memorable event that combines both an in-depth exploration of the state of science in the developing world and a festive celebration that we can all enjoy. We anticipate that several hundred people will attend, including a large number of TWAS members and scientists from around the world."

Highlights of the meeting and celebration will include

- *A series of Jubilee Lectures given by such eminent scientists as Mario Molina (Nobel Laureate, Chemistry 1995); Harold Varmus (Nobel Laureate, Physiology or Medicine 1989); Srinivasa R.S. Varadhan (Abel Prize Winner 2007); and Martin Rees (Craaford Prize Winner 2005).*
- *A wide-ranging series of symposia focusing, for example, on genes and human health; the state of mathematics; the growth of the knowledge economy in the developing world; megacities in the South; nanoscience; physics; and climate change.*
- *A ministerial forum examining strategies for enhancing South-South cooperation in science, technology and innovation.*
- *A half-day symposium on the state of science and technology in Mexico.*

In addition, there will be formal ceremonies honouring TWAS prize and medal winners followed by lectures by the winners describing their award-winning work; presentations by C.N.R. Rao Prize recipients; and scientific lectures by TWAS Young Affiliates showcasing their research. TWAS business, committee and council meetings will precede the three-day event. ■

For additional information about the TWAS 19th General and 25th Anniversary, contact info@twas.org

TWAS ENDOWMENT FUND UPDATE

TWAS will relaunch its endowment fund campaign as part of its 25th anniversary. The ultimate goal of the campaign, which will continue through 2012, is to reach the new $25 million target set for the fund at the last TWAS general meeting held in Trieste in November 2007. A new brochure for the endowment fund campaign is now being prepared and letters urging members to contribute to the fund will be sent to all TWAS members. The Academy also plans to approach governments from both the developed and developing world as well as international foundations for contributions.

"Our goal", says Jacob Palis, TWAS president, "is to reach a total that will enable the Academy to fund all of the costs of the secretariat from interest earned on the principal of the fund. That will allow the Italian contribution to TWAS to be used exclusively for programmatic activities."

For additional information about the TWAS endowment fund campaign, contact the TWAS secretariat at info@twas.org.

SERVING SCIENCE IN OIC COUNTRIES

EFFORTS TO PURSUE SCIENCE, TECHNOLOGY AND INNOVATION IN MEMBER STATES OF THE ORGANIZATION OF THE ISLAMIC CONFERENCE (OIC) ARE WOEFULLY INADEQUATE. BUT THE TIDE CAN BE TURNED AND SCIENCE ACADEMIES CAN LEAD THE WAY, SAYS TWAS EXECUTIVE DIRECTOR MOHAMED H.A. HASSAN.

The ineffectiveness of the member states of the Organization of Islamic Conference (OIC), an association of 56 Islamic states promoting Muslim solidarity in economic, social and political affairs, to embrace science and innovation is readily discernible by a number of statistical measures.

For example, OIC countries have 8500 scientists, engineers and technicians per million population, according to a recent report by the Organization for Economic Co-operation and Development (OECD). The world average is 40,000 per million. Among rich countries, the figure reaches 140,000.

Similarly, the world average for the production of scientific articles per million inhabitants is 137. The average among OIC countries is 13. Scientists in Italy, a country of 58 million people, publish more articles in peer-reviewed international scientific journals than scientists in OIC countries, which have a collective population of 1.4 billion.

This picture of science in the Islamic region is even bleaker when it comes to applications of science and technology to economic development – in other words, when it comes to innovation.

As Declan Butler, a science journalist who writes for *Nature*, observed in an article last year, "OIC countries produce so few patents that they are invisible on a

bar chart of comparison with other countries." And, as Perez Hoodbhoy, professor of physics at Quaid-e-Azam University in Islamabad, Pakistan, noted in a recent article for *Physics Today*: Pakistan, with more than 165 million people, has produced just eight international patents in the past four decades.

PLUGGING THE GAP

How can OIC countries bridge such an alarming science and innovation gap?

It will take sustained commitments on the part of governments to improve national educational systems. To some degree, that is already happening in higher education. Reform, however, has been less prevalent in primary and secondary schools.

Equally important, OIC countries have yet to provide adequate job opportunities for their increasingly well-trained university graduates. And the more conservative OIC countries have yet to take significant steps to address the challenges posed by gender inequality.

It will take an unwavering willingness on the part of wealthy citizens in OIC countries to invest in the region and to avoid placing money, sorely needed for economic development and jobs creation at home, in banks and stock exchanges in Europe and the United States.

It will take policy and regulatory reforms that promote entrepreneurial behaviour, reward success and encourage public-private sector partnerships.

It will take broad measures of reform that spur new ways of thinking and acting, that radically alter conventional patterns of behaviour and that introduce novel practices and methods to deeply conservative nations – measures that create a culture of science and innovation.

ACADEMIC ROLES

An examination of the shape of these reforms and how they might be implemented requires more than a brief commentary. Instead, I will briefly focus on a narrow – but potentially significant – aspect of the challenge: How national merit-based science academies can help promote science and innovation in the Islamic region.

The limitations of science academies in OIC countries are obvious to all who care to look.

Part of the problem lies in their small size and limited resources. The OIC's smallest academy, in Albania, has 27 members. The largest science academy, in Uzbekistan, has 155 members. Many academies in OIC countries operate on meagre budgets, some on less than US$50,000 a year.

Another problem lies with the academies themselves, which are institutions largely divorced from their nations' centres of power. They have often exacerbated their isolation by behaving like 'gentlemen's clubs', blissfully free of the troubles affecting their troubled societies.

But academies have strengths as well.

These institutions contain some of a nation's best minds. Those



who belong to academies are often familiar with successful efforts to promote science and science-based development in other regions of the world. Close ties to the international scientific community make them ideal candidates for bringing new ideas and new insights to address the challenges facing their societies.

Academies of science are, in short, capable of serving as agents of science-based innovation.

TRANSFORMATION

The challenge is to transform the largely untapped potential of science academies into tangible accomplishments that generate both personal rewards and benefits for society.

We are beginning to see this transformation slowly take hold in some OIC countries. These efforts have been assisted by the Inter-Academy Panel on International Issues (IAP), a global network of science academies headquartered in Trieste, Italy, and by the Network of Academies of Science in the Countries of the Organization of the Islamic Conference (NASIC), a regional network of science academies affiliated with IAP and headquartered at the Pakistan Academy of Sciences in Islamabad.

Their efforts have paid off in the creation of science academies in OIC countries where they did not exist. The Sudanese National Academy of Sciences was created in 2005. The inaugural meeting of the Mauritius Academy of Sciences took place in July of this year. The Lebanese Academy of Sciences is scheduled to hold its first meeting later this year. The government of Mozambique passed a decree to create a national science academy, which is scheduled to be launched later this year as well.

Equally important, we are beginning to see this transformation take hold in the academies themselves. For example, in August 2007, the Malaysian Academy of Sciences organized an international symposium cosponsored by the Ministry of Science, Technology and Innovation, and in September 2007 it held a training course on science and technology management for researchers from OIC countries.

Whether such efforts will turn into a full-fledged regional transformation of the relationship between science academies and society remains to be seen.

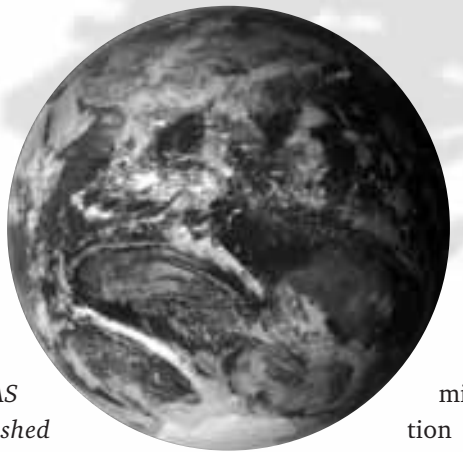
This much we know: science academies can play a critical role in encouraging not just the pursuit of science but also the pursuit of science-based development. It's all a matter of innovation, not simply within classrooms and laboratories but within society as a whole.

Mohamed H.A. Hassan
Executive Director, TWAS

A similar version of this article was originally published in scidev.net on 3 October 2007. See www.scidev.net/en/opinions.

A NEW CLIMATE FOR CHANGE

WHAT WILL CLIMATE CHANGE MEAN FOR THE DEVELOPING WORLD, AND WHAT STEPS NEED TO BE TAKEN TO MITIGATE THE IMPACT OF CLIMATE CHANGE AMONG THE WORLD'S POOREST PEOPLE?



In the following article, Jagadish Shukla and Daniel Schaffer describe the current state of scientific knowledge on climate change and explore a range of measures that might be taken to meet the complex challenges that it poses to the Earth's well-being. Shukla (TWAS Associate Fellow 1995), Distinguished University Professor of Climate Dynamics at George Mason University and president of the Institute of Global Environment and Society, USA, is one of the world's foremost climate modelers. He recently served as a lead author for the Intergovernmental Panel on Climate Change (IPCC) Group 1 report, which examined the full range of scientific evidence that is driving our understanding of this critical global issue. Schaffer, the TWAS Public Information Officer, has written extensively on science and technology issues in the developing world.

Climate change issues have been in the news a great deal lately. And that's all for the good. The altering of the Earth's climate, after all, could be the most critical issue that the world has ever faced. As Albert Gore, who shared the 2007 Nobel Peace Prize with the Intergovernmental Panel on Climate Change (IPPC), noted in his Nobel address:

"Today, we dumped another 70 million tons of global-warming pollution into the thin shell of atmosphere surrounding our planet, as if it were an open sewer. And tomorrow, we will dump a slightly larger amount, with the cumulative concentrations now trapping more and more heat from the sun.

"As a result, the earth has a fever. And the fever is rising. The experts have told us it is not a passing affliction that will heal by itself. We asked for a second opinion. And a third. And a fourth. And the consistent conclusion, restated with increasing alarm, is that something basic is wrong.

"*We* are what is wrong, and *we* must make it right."

It is fair to say that a global consensus has now been reached on the risks that climate change poses for the global community. Australia joined the Kyoto

Protocol in December 2008. China and India have agreed that the risks created by global warming must be addressed now and not in the future (although not at the expense of economic growth), and even the current government in the United States, which has been the most skeptical and obstructive member of the global community when it comes to addressing issues related to climate change, has recently acknowledged that it is a problem that demands the world's attention.

The key question is no longer whether climate change should be a central global concern (indeed many now believe that it is a global emergency). Instead the key question now is how climate change will manifest itself regionally and what can we do about it.

FOLLOWING IPCC'S LEAD

IPCC has been the primary institution responsible for increasing public understanding of the climate change issues. The way in which IPCC has functioned provides a valuable model for others to follow when addressing global concerns of great consequence.

The principles of the IPCC are there for all to see: the creation of a broad international operational framework led by the world's top scientists; meticulously prepared, peer-reviewed publications; clear and concise demarcations between various aspects of the problem (scientific evidence, mitigation, adaptation); in-depth analyses of each issue based on the most current and well-respected scientific findings, accompanied by crisply written summaries designed for an educated lay audience. The latter are not dummy-downed versions of the scientific reports but comprehensive analyses of the nature of the problem intelligently written for the audience in mind.

Indeed the most important contribution of the IPCC has been to lay out, in an understandable and convincing way, what scientists know about the problem and what broad options, in its learned opinion, may be available to address this challenge – provided that society chooses to do so. And that's a key point: It's not up to the scientific community to act; it's up to society.

The IPCC may well represent a revolutionary strategy for presenting scientific findings of great import. But in most ways, its methodology – and, more generally, its way of operating – are as old as science itself: Conduct a thorough investigation; engage in careful and unbiased analysis; be assured that there is consensus within the scientific community on the issues for which you draw conclusions; and be prepared to

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The Earth has a fever, and the fever is rising.

revise, even change the assessment, if new data and information lead to a new conclusion.

QUESTIONS AND ANSWERS

As we approach this critical juncture in discussions on climate change – a time when both the global community and national governments seem poised to meet the challenges that rising levels of greenhouse gases pose to the planet's well being – it might be useful to look back and examine exactly what the scientific community knows about the issue (and what it doesn't know). It would, however, be even more useful to look forward, outlining the next steps that the scientific community needs to take to refine its knowledge and to determine the level of resources it will need to do so.

More generally, at this critical juncture in the discussion, we should take time to examine the questions and issues that the scientific community cannot answer, or that can only be answered by society itself.

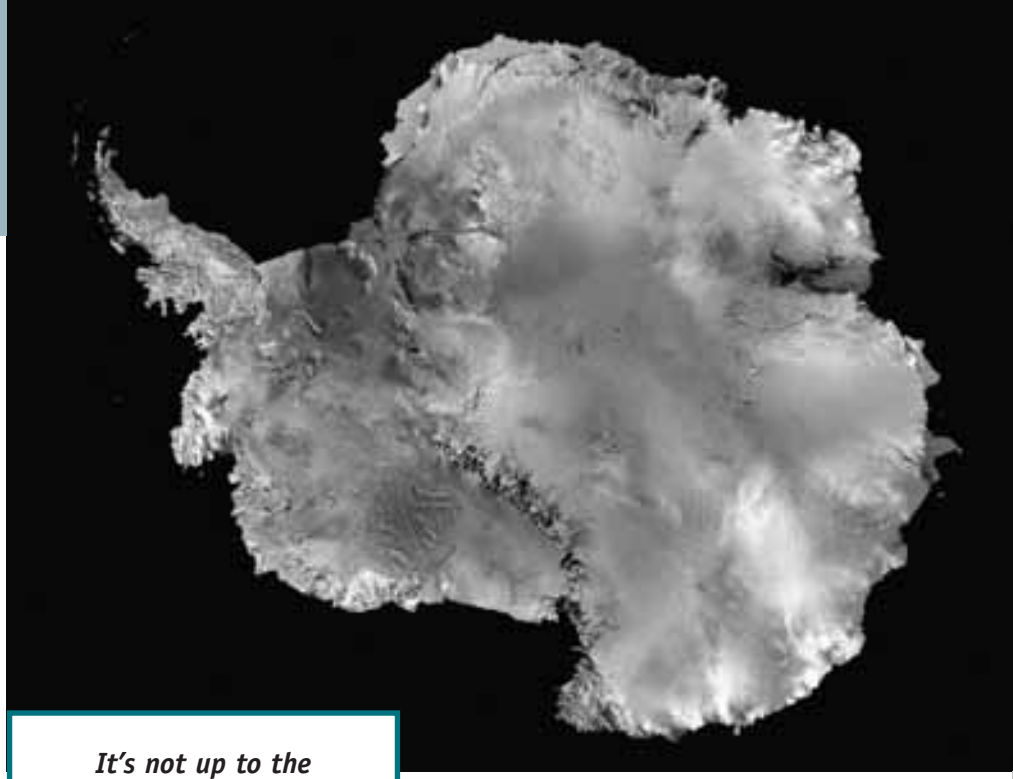
For example, what are the tradeoffs that exist between near-term economic development and long-term economic sustainability? What mechanisms should be put in place to ensure that those who have been least responsible for the problem are not the ones most burdened by climate change's anticipated impacts? What role should technology – new and old – play in efforts to combat global warming and its consequences, and at what costs financially? What role should societal reforms play (for example, broad efforts to change patterns of consumption and production) and at what costs to individuals and communities? And how can we devise an effective strategies for dealing with climate change issues when there is so much that we still don't know in terms of regional impacts, the pace of the change and the unsettling prospects for reaching tipping points from which there will be no turning back.

In a sense, then, it might be useful to create a research scorecard listing the knowns, the unknowns and the unknowables.

INSTITUTIONAL MANDATE

The IPCC was established in 1988 by two United Nations organizations: the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP). Its mandate is to assess scientific, technical and socio-economic information relevant for the understanding of climate change. The IPCC is also authorized to examine potential impacts and possible options for adaptation and mitigation when dealing with climate change. Since its inception, it has produced four sets of 'assessment' reports – in 1990, 1995, 2001 and 2007.

Each series of reports has drawn its conclusions from a stronger base of scientific evidence and each has reached more convincing conclusions that human activities are the primary cause of the climate change, that the pace of change is accelerating, and that the impacts are becoming more troublesome and intractable. Indeed the last report concluded that the: "Warming of the climate is unequivocal, as is now evident from observations of increases in global aver-



age air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level."

Three separate working groups have been responsible for the work of the IPCC: the physical sciences (working group 1); impacts, adaptation and vulnerability (working group 2); and mitigation (working group 3).

It's not up to the scientific community to act; it's up to society.

KNOW THIS

IPCC's assessments have been able to draw a detailed portrait of atmospheric concentrations of carbon dioxide, methane and nitrous oxide over the past 10,000 years, thanks largely to their ability to measure isotopes lodged frozen in ice cores.

What scientists have observed is that concentrations of these gases remained stable for thousands of years until about 1750 when the levels of gas began to rise in parallel with the industrial revolution. What scientists have also observed is that the level of carbon dioxide, the primary greenhouse gas, has risen more than 80 parts per million (ppm) or 25 percent since 1970, and that the levels of methane and nitrous oxide have also increased substantially during the same period. All told, in 2005 greenhouse gas concentrations in the atmosphere were at a level of about 380 ppm. In 1750, the figure stood at 280 ppm; in 1850, it still registered 280 ppm; and in 1950 it was 300 ppm.

At the same time, a rise in mean global surface temperature of about 0.7 degrees Centigrade in the last century has been observed. This rise in temperature followed on the heels of a slow, virtually imperceptible, increase in temperature during the previous 150 years. Thus it seems that the greenhouse gas buildup that began in 1750 took some time to gain momentum and exert its impact. However, as we have continued to emit these gases into the atmosphere at ever-higher levels, the pace of warming has accelerated.

And there's more. Eleven of the past 12 years have been the warmest on record. And, in the past 500 years, the average warmest temperature for any 50-year period took place between 1951 and 2000.

Temperatures are not the only factor to consider. Ocean acidity is increasing. Scientists have found an annual 1.8 millimetre rise in sea levels since 1961. If we begin calculating the average in 1993, the annual rise in sea levels jumps to 3.1 millimetres. The ice mass floating on the Arctic sea has been reduced by 2.7 percent per decade since 1978, and in 2007 scientific surveys indicated that the Arctic's ice mass had shrunk to a record low level. Recently, scientists have observed even more alarming evidence of loss of Antarctic ice mass.

There have also been enhanced run-offs and an ever-earlier peaking of springtime discharges from many glacier- and snow-fed rivers. The number of hot nights has increased across climate zones while the number of days with frost has decreased. Flowers and trees now bloom earlier in spring and an increasing number of plant and animal species are moving into new habitats at higher elevations and closer to the poles – habitats that were once too cold, but are no longer. Algae and plankton seem to be thriving and

expanding their presence in global waterways, responding to the warmer temperatures and longer summers.

This is what the scientific community has assessed and accepted. Its efforts have provided irrefutable evidence that the levels of greenhouse gases in the atmosphere have increased substantially since 1750 and that the pace of the increase is now accelerating. The scientific community has also shown that surface temperatures are climbing, that ice packs and glaciers are receding; that sea levels are rising; and that both plants and animals are responding to the changing climate and ecological changes that inevitably result from altered temperature and changing patterns of precipitation. These are observed and irrefutable facts. Recording the changes in a systematic way, backed by scientific analysis, provides a vast storehouse of evidence that is beyond challenge.

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But is the relationship between rising greenhouse gas emissions and the world's changing climate a provocative but unusual coincidence or does it carry the weight of a proven scientific correlation?

Here's what scientific studies and modelling tell us. First, there is no scientific model that can explain the past 50 years of observed global warming without turning to the increased levels of greenhouse gases as the drivers of climate change. Put another way, there is no other mechanism known to scientists that can explain what is behind the warming of the atmosphere, ocean and land except the spilling of large amounts of greenhouse gas into the atmosphere. These gases are the only suspects and, according to the models, they stand guilty as charged.

But the models can help us look forward as well as backward, assisting us in anticipating the changes that lie ahead under different scenarios. Scientists agree, for example, that both global temperatures and sea levels will continue to rise for centuries regardless of whether current levels of greenhouse gas emissions are stabilized in the near future. That's because the gases continue to reside in the atmosphere long after they have been released. Indeed, we will live with the legacy of greenhouse gas emissions for centuries, and we will have to devise policies for this reality even if we succeed in significantly curbing the levels of future emissions over the next few years.

Scientists also agree that in addition to a rise in temperatures we can expect an increase in the frequency of heat waves and heavy rains. That is because a hotter atmosphere 'carries' more water, and more

water in the atmosphere will fuel more intense weather. And, finally, there is now a consensus that the Arctic sea ice will disappear in the late summer months by 2100 with a potentially significant ecological impact worldwide.

WHAT WE DON'T KNOW

The knowledge base is both impressive and growing. But there is plenty that scientists still don't know. For example, despite all of the evidence they have gathered about climate change, scientists cannot predict the occurrence of a single event. Put another way, scientists know that there will be changes in the frequency of storms and that these storms will be more intense, but they cannot tell where or when a hurricane with the clout of Katrina or a cyclone with the force of Vance will strike.

On a less dramatic note, scientists cannot predict the degree of climate change that is likely to occur at a regional scale. That's because today's computer models have a resolution of 200 square kilometres. Analysis at a regional scale will necessitate computers with a resolution of 20 or, preferably, 10 square kilometres. This can only be done with computers 10,000 times faster than those operating today.

Scientists, moreover, cannot predict if and when the Greenland ice sheet will melt. That's an important piece of information because if it happens, sea levels will rise on average by 7 metres, placing many coastal cities under water. Scientists do not yet know whether the Antarctic ice sheet is too cold to melt or whether, instead, it will gain mass due the additional snowfall that will accompany a wetter climate. Scientists do not know, as well, the level of species extinction that may occur as a result of global warming, although estimates suggest that a rise of 1.5 to 2.5 degrees Centigrade could cause a 20 to 30 percent loss in species and that a 4 degree rise could result in a 40 percent loss worldwide. And scientists do not know the reduction in the amount of carbon absorption that might take place in the oceans, a potentially aggravating factor that could intensify the impact of greenhouse gas emissions.

DELAY AND PAY

Some political leaders say that addressing the climate change issue too aggressively could impede economic growth. What the skeptics prefer not to talk about is this: Dithering in our response has adverse economic consequences too. Think of foregoing maintenance on the roof of your house. It may keep money in your pocket now, but it would likely cost you much more in the future as the slow leak spreads and leads to more serious roof and structural damages.

That is exactly the point of the 2006 Stern Review on 'The Economics of Climate Change.' Nicholas Stern, a scientist who served as economic advisor to the

The knowledge base is both impressive and growing. But there is plenty that scientists still don't know.

British government and who now holds the IG Patel Chair at the London School of Economics and Political Science, has warned that ignoring the impacts of climate change today will undermine economic growth in the future as the pace of global warming and the damages it inflicts on society accelerate and intensify. Damages, he asserts, could be on the scale of global conflicts such as World Wars I and II or comparable to the global economic depression of the 1920s and 1930s.

But unlike these past events, once the full force of global warming takes hold, Stern asserts that it will be difficult to reverse. In short, he maintains that the earlier we act, the less costly it will be. And since the most vulnerable citizens among us are likely to be those who suffer the most, mitigating global warming's impacts will help the people most in need. Stern even places a monetary value on efforts to act quickly and effectively. He estimates that measures taken to stabilize greenhouse gas emissions at 550 ppm by 2050 will shave 1 percent from the annual global GDP. If we procrastinate and do nothing, however, Stern counsels that economic losses due to climate change – as a result of storm damage, declining agricultural yields, population relocations and other factors – could slice annual global GDP by 5 percent over the same period.

Nicholas Stern

The lesson is this: Pay now or pay later. If we choose to pay later, we will pay more, a great deal more.

As we move into the future, the scientific community can help inform the public about the pace and risks posed by climate change. But like the rest of society, it must also operate in a world of unknowns.

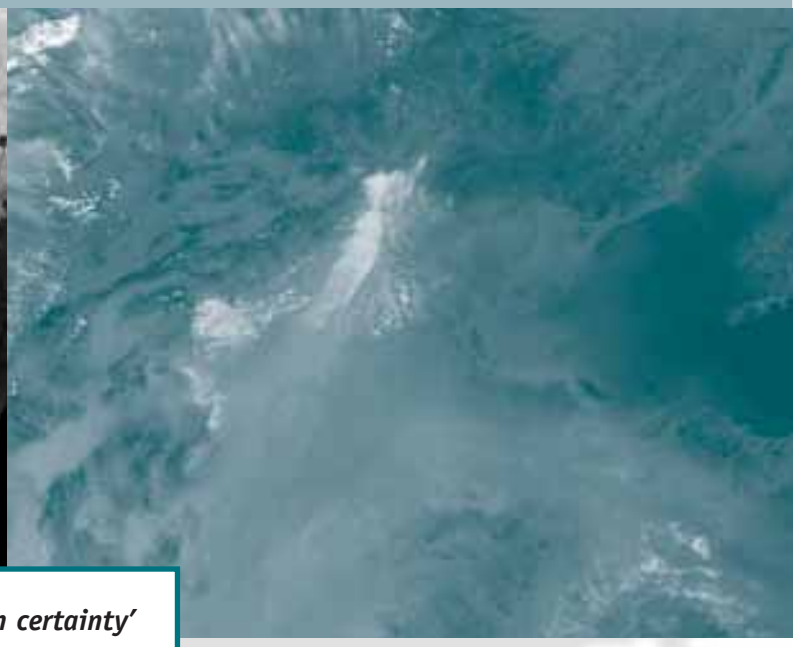
Scientists, for example, know that substantial adaptation and mitigation of climate change's impacts can be achieved with existing technology. But they cannot predict what breakthroughs in science and technology might take place in the future, leading, for instance, to viable alternative sources of 'green' energy or effective systems to capture and store carbon.

Scientists also know that important steps can be taken to relocate large numbers of people from coastal areas that are most vulnerable to rising sea levels. But they cannot predict if or when such measures will be taken.

Scientists know, as well, that abrupt and catastrophic changes are possible as a result of climate change but they cannot determine if or when such tipping points will be reached.

And, scientists understand the broad dynamics of climate change but they cannot say with any degree of specificity what the climate will be like in 2050 or 2100, especially at a regional or local level.

In a political world where decisions are often short-term and where leaders cherish detailed information providing a clear roadmap for action, the 'uncertain certainty' of climate change creates a serious handicap for devising initiatives that bring scientific findings into the policy arena.



The 'uncertain certainty' of climate change creates a serious handicap.

TALLYING UP

So here's the scientific scorecard as it stands today.

Is global climate being affected by human activities? The answer is an unequivocal yes.

Can it be mitigated and contained? Again, the answer is yes. But only if we act with the sense of urgency that the issue demands and only if we are able to get all of the main players – from both the developed and the developing world – on board.

Will we succeed in meeting the challenges of global warming? That is not an issue for the scientific community to answer. Scientists can inform. They can present and analyse trends and options. They can project the future based on the best scientific data and models available. But they cannot initiate action on their own; nor would society want them to.

Global climate change is a global problem that will require global action. Scientists have presented a compelling portrait of what is happening and have convincingly outlined what may unfold in the future. But society must ultimately shoulder responsibility for doing something about a problem that UN Secretary-General Ban Ki-Moon has called the "defining issue of our era".

So, will society act? That's an open question that remains to be answered.

The climate of opinion is changing for the better. The climate itself is changing for the worse. Humanity is in an unprecedented race in which we are competing against ourselves. The race is not 'we' against 'them'. It is a race of 'us' against 'us'. So the question is ultimately not which one of us wins, but whether we can work as one to successfully solve this problem together. ■

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TUNISIA'S BIOTECHNOLOGY CENTRE

SCIENTIFIC AND TECHNOLOGICAL CAPACITY IN THE DEVELOPING WORLD CONTINUES TO EXPAND AT A RAPID PACE. THAT'S THE GOOD NEWS. YET, FOR THIS CAPACITY TO BE SUSTAINED AND STRENGTHENED INTO THE FUTURE, IT MUST BE INSTITUTIONALIZED IN UNIVERSITIES AND RESEARCH CENTRES ACROSS THE SOUTH AND NOT SIMPLY HELD IN TRUST BY A FEW TALENTED AND WELL-TRAINED INDIVIDUALS.

As part of a larger effort to help build and promote strong and sustainable scientific institutions in developing countries, TWAS, with support from a number of donors, has been engaged in a decade-long initiative to profile a large number of successful scientific institutions in the South. The effort has been driven by two key questions: What can policy makers and administrators at scientific institutions learn from the experience of others, and how might they apply this knowledge to improve their own institutions? With a generous grant from the David and Lucille Packard Foundation, TWAS has recently conducted comprehensive profiles of five highly successful scientific institutions in the developing world. The following is a brief summary of the work of one of those institutions: The Center of Biotechnology of Sfax in Tunisia. The complete 50-page profile can be obtained from the TWAS Secretariat at info@twas.org.

When asked whether the Centre of Biotechnology of Sfax (CBS) is a success, director-general Hamadi Ayadi answers with an emphatic "yes". In fact, it would be difficult to find anyone who would answer differently among the centre's 200-plus staff of scientists, engineers, technicians and students

On a continent that has yet to fully embrace the so-called biotechnology 'revolution', and where such research is lagging, CBS is certainly ahead of the game. CBS researchers are busy exploring biotechnology's wider applications and, in particular, seeking practical solutions to local and regional problems in agriculture, industry, health and the environment.

BIO-IMPROVED OLIVES

As is true in many Mediterranean countries, Tunisia – with its hot, dry summers and warm, wet winters – enjoys an ideal climate for olive cultivation. Indeed one third of the country's arable land is devoted to olive cultivation – 1.6 million hectares. Tunisia is second only to Spain in olive production, and its 60 million olive trees represent nearly 20 percent of the world's olive orchards. The 'immortal' olive tree – believed to have been cultivated in the region since the 7th century BCE – continues to play a vital role in the Tunisian economy. Today most olives in Tunisia are grown for their oil. Not only is olive oil a staple of the famous Mediterranean diet. It is also an important export product. The country is the world's fourth-largest producer of olive oil, producing some 170,000 tons a year. It's also the world's second-largest exporter.

But the nearly one million Tunisians for whom the olive oil industry provides an income are not the only ones living off the olive tree. Prays oleae*, the olive moth, is a major pest in the region. In a typical year, three generations of this moth plague the orchards, each associated in its larval stage with different parts of the tree.*

First-generation larvae, for example, feed on the flower buds. Third-generation larvae feed on the leaves. But it is the second generation – when larvae grow inside the olive kernels, before emerging to pupate – that has proven the most harmful. Their destructive force often causes massive fruit drop and damages the remaining fruit for oil making. Oil from olives affected by the moth has an oxidized, rancid or 'dirty' taste.

Second-generation olive moths are currently controlled by the application of chemical insecticides. The CBS Laboratory of Biopesticides has conducted successful research on a potentially more effective method of combating this major pest – applying new biological pesticides to first-generation olive moths when females lay their eggs on the blossoms.

These new bio-insecticides are based on Bacillus thuringiensis *(Bt), a naturally occurring, soil-dwelling bacterium. "Some Bt strains have proven very effective against this pest", says laboratory director, Samir Jaoua. "In collaboration with the national Olive Tree Institute, in Sfax, strains obtained were successfully tested on 39 olive trees." Test results have been shared with the Olive Tree Institute for wider application.*

CBS was launched in 1983 in a small corner of the University of Sfax's School of Engineering. Today the institute sits at the centre of its own campus, a tangible reflection of a US$10-million investment. The campus will soon cover eight hectares, once the two new wings currently under construction are complete.

When discussing the history of the centre, one name constantly crops up: Radhouane Ellouz, CBS's founding director. Ellouz is widely considered – not just in Tunisia, but also throughout the continent – as the father of biotechnology in Africa. A lecturer in biochemistry early in his career, Ellouz was the first dean of the Faculty of Science at the University of Tunis. Ali Gargouri, head of the CBS Laboratory of Eukaryotes, recalls that "when Ellouz took charge of the faculty, he changed many programmes and introduced genetic engineering, which people found very strange at the time."

Ellouz began to think seriously about biotechnology and the possibility of establishing a dedicated research centre in the early 1970s. "It took almost a decade and a half to put it together. As often happens when you start something new, there were many challenges and difficulties along the way. You have to go step by step", says Ellouz.

Ellouz's first step was to nurture the necessary human resources. He achieved this by identifying promising science undergraduates in Tunisia and arranging for them to continue their studies in Europe, mainly France, because of the common language. The risk was that many students would not come back. In Africa, no one can ignore the threat posed by 'brain

drain'. After all, more African scientists work outside Africa than on the continent.

How did Ellouz ensure that his young charges would return home? "I had to keep in constant touch with them", he recalls. "I would even travel to Europe to talk to them. We would discuss what they would do when they returned to Tunisia. That was the biggest challenge – making work available and assuring them that there would be research projects for them when they came back. At that point, we did not even discuss money."

Ellouz's devotion and human touch paid off. Today, the majority of scientists at CBS are, in his words, his 'academic grandchildren'.

The second obstacle standing in the way of success was resistance to using biotechnology techniques. "Many people, still today, are wary of biotechnology", explains director-general Ayadi, "because, even if they understand its benefits, they fear it won't be used well or equitably. And so, they think it would be better not to use it at all."

Confronted with such resistance, Ellouz sought to convince decision-makers that biotechnology could help to solve a host of critical problems. He did so by arranging a series of conferences and meetings to which he invited a broad range of influential constituencies. His efforts culminated in the Tunisian government's decision to implement a 'biotechnology plan'. This, in turn, led to the creation of CBS in autumn 1983.

CBS researchers are seeking practical solutions to local and regional problems.

Between 1983 and 1987, the centre operated largely within the University of Sfax's School of Engineering. A turn toward independence came in 1987, when the United Nations Development Programme (UNDP), through a contract with the Tunisian government, awarded the centre a US$1.5 million grant to develop research projects based on Tunisia's development priorities. In particular, the grant called on the centre to target its efforts on the research and production of enzymes with industrial applications. Ellouz explains, "UNDP gave the money on the condition that CBS commission senior researchers to work on the project." Ellouz did this by calling on Tunisian scientists working in France.

BIO-STONED BLUE JEANS

In its research on industrial applications of enzymes, the CBS Laboratory of Molecular Genetics of Eukaryotes has selected some local fungal strains that produce alkalophilic cellulases and xylanases – that is, which act as alkaline pH.

Such enzymes can be used in the 'bio-stoning' – rather than 'stone-washing' – of denim fabrics, to give blue jeans a faded, worn-out look and soft worn-in feel.

"These enzymes can replace the pumice stones ordinarily used, which Tunisia imports from Turkey", says Nabil Zouari, director of the Unit of Valorization of Research Results. "One cup of enzymes produces the same results as 50 to 70 kilogrammes of stones."

Bio-stoning results in a much more uniform fading (as the enzymes can reach deep into the pockets and seams). Not surprisingly, it also much gentler on the material than pumice stones, thus reducing the number of defective garments.

"Since enzymes are biodegradable, their use also greatly reduces pollution", Zouari adds. "In addition, using enzymes can lower costs, especially if we lower the costs of their production by selecting mutant strains of bacteria that over-produce these enzymes."

Since then, various government decrees – for example, the finance laws of 1988 and 1989, which spelled out the centre's organization, and the prime minister's decree of 1998, concerning the creation of CBS's research laboratories – led to the institute's current structure. CBS became an independent institution in January 1989 when its budget became officially integrated into the state budget. In 2001, the Tunisian Ministry of Scientific Research, Technology and Competency Development announced the creation and composition of CBS's board of directors and scientific council.

CBS AT WORK

For the past 15 years, CBS has been exploring biotechnological solutions to some of Tunisia's more pressing problems in four key areas: agriculture, industry, health and the environment.

Agriculture plays a vital role in the Tunisian economy and way of life. Barley, citrus, dates, olives and wheat are grown on land that is suitable for cultivation. The livestock industry produces beef, dairy products and poultry. Agriculture accounts for less than 13 percent of Tunisia's gross domestic product (GDP). Yet it employs 55 percent of the work force.

In addition to crop pests and diseases, Tunisian farmers must deal with problems related to desertification – including water scarcity and soil salinization – which reduce both crop yields and the amount of arable land. CBS researchers are working on developing drought- and salt-resistant varieties of wheat, biological pest controls, and other ways of increasing production and food security in the region.

Industry makes a larger contribution to the country's GDP (31 percent) and employs nearly 25 percent of the work force. Main industries include phosphate and iron ore mining, petroleum and textiles. CBS researchers are seeking ways to help Tunisian industries enhance manufacturing processes to improve productivity. At the same time, they are working on new solutions to more effectively dispose of toxic and hazardous industrial wastes that pose serious environmental and health-related risks.

CBS is among the finest biotechnology centres on the African continent.

In the area of health, CBS scientists are researching potential therapies for three types of cancer. They are also developing ways of extracting biophenols – a source of natural antioxidants – from olive by-products.

The centre's administrative framework consists of four laboratories devoted to the study of enzymes and metabolites, molecular genetics, biopesticides and bioprocessing, and three research and support units focusing on plant molecular genetics, the valorization of research results (with responsibility to find useful applications for the research and laboratory work) and scientific information and documentation. The centre's service departments provide assistance in informatics and bioinfomatics, culture collection, analysis and maintenance. All in all, CBS is among the finest biotechnology centres on the African continent.

SWEET SUCCESS

A highlight of Tunisian cuisine are its delicious sweets and pastries, based on ingredients such as almond paste, pistachios, flour, honey, sugar and butter, which come in a delightful variety of shapes and colours.

Sfax is the capital of the Tunisian pastry, and manufacturers there have been wondering what to do with 'spoiled' sweets. Each day, a typical factory may produce more than 5000 kilogrammes of pastries that are judged to be unsuitable for the market and therefore need to be recycled.

The delicate pinks, greens and yellows that colour the sweets, when mixed together, result in an unattractive dark hue. So, batches need to be discoloured before being reused.

"To solve this problem, we developed an industrial process of decolourization", says Nabil Zouari, director of the Unit of Valorization of Research, which seeks to turn the centre's research findings into valuable products and services. "We also created chemical techniques adapted for the proportioning of sugars in confectionery products."

One popular treat in the region is halva, which is made from ground sesame seeds (or tahini). The tahini and sesame oil in such products easily separates and is also relatively unstable due to oxidation. Halva manufacturers would like to stabilize the oils so they do not separate between the oil and solid phases.

CBS has found a solution by using biotechnology processes to extract alimentary fibres from the husks of the sesame seeds. "By incorporating fibres into the products, you get both good texture and stability", explains Zouari. "Such alimentary fibres are technologically interesting and could be added to more oil-rich foods to improve their stability and texture."

"Aside from acting as stabilizers," continues Zouari, "fibres have many other interesting characteristics." For instance, they retain water. "They are very good for you because they aid the passage of food through the intestine and help prevent colon diseases." And the sesame fibres, found in the husks, also contain antioxidants, mainly hydroxytyrosol, which medical researchers believe may help combat cardiovascular diseases.

COMBATING CANCER

The 'tumour suppressor' gene called 'p53' – known as the 'guardian of the integrity of our genome' because of its ability to stop the formation of tumours – is the object of intense research by the scientists in CBS's Laboratory of Molecular Genetics of Eukaryotes.

They, along with their colleagues in the Laboratory of Enzymes and Metabolites of Prokaryotes, are working on potential therapies for three different types of cancer: nasopharyngeal cancer, breast cancer and bladder cancer.

"The p53 gene has been implicated in more than half of all sporadic human cancer", explains Ali Gargouri, head of the Laboratory of Eukaryotes. "If a person inherits only one functional copy of p53 from their parents, they are predisposed to cancer and usually develop several independent tumours in a variety of tissues in early adulthood."

CBS has been working on a project in collaboration with a group headed by Mehmet Öztürk, at Bilkent University in Ankara, Turkey. The Turkish colleagues produce p53 in bacteria, while CBS researchers produce it in yeast. "Surprisingly, we discovered that when p53 is produced at a high level in yeast it makes the cells grow very slowly. We are now studying this negative effect by selecting mutant yeasts that escape this effect", Gargouri says.

At the same time, the laboratory has studied the molecular nature of p53 mutations in tumour DNA in breast cancer among women in the Sfax region and from bladder cancer patients in the Sousse region (midway between Sfax and Tunis). In cooperation with doctors from Sfax Hospital, they have investigated whether p53 – and the behaviour and interaction of other proteins – would help in understanding tumour progression and the outcome of patient therapies.

The laboratory, along with Sfax Hospital, is also studying nasopharyngeal cancer. "There is an interesting aspect for us in nasopharyngeal cancer", explains Gargouri. "Unlike the rest of the world, where this cancer mainly affects elderly people, in the Maghreb region, there are two peaks – in young people and in adults."

We have enough funding. It's not a lot, but it's sufficient for our activities.

LOCATION MATTERS

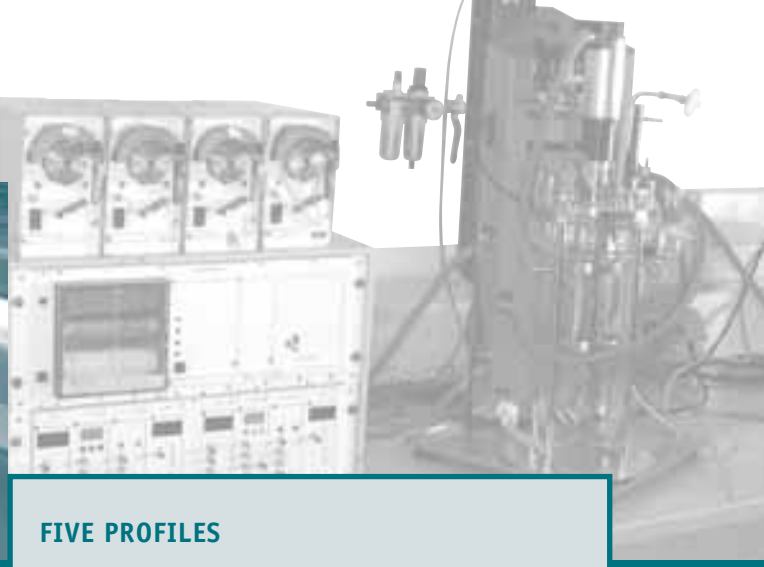
The centre is located in Tunisia's second-largest city Sfax, on the country's east coast, midway between the northern shores and southern border with Libya.

Sfax lacks the glamour of Tunis, the country's cosmopolitan capital, which lies 270 kilometres to the north, and the tourist appeal that have made other Tunisian cities, such as Hammammet and Sousse, famous.

One reason for this is that its coastline does not have an attractive beach. Sfax is also living with the legacy of a former industrial zone, which has created a formidable barrier separating the city from the Mediterranean Sea.

Researchers at CBS stand by their city and maintain that a major reason for the institute's success lies in its location. It is widely held that the people of Sfax are the most hardworking and enterprising in Tunisia. Indeed Sfax remains at the heart of the Tunisia's industrial sector. It is the country's largest economic centre and the main source of industrial employment in southern Tunisia. In addition, its educational system and universities are rated higher than even those of Tunis.

One does indeed notice a sense of seriousness in the corridors, offices and laboratories of the centre. In addition to the researchers' hard work, skill and dedication, there is another important factor in CBS's success – the Tunisian government's growing commitment to science and research.



FIVE PROFILES

Funding from the David and Lucile Packard Foundation enabled TWAS to publish in-depth profiles of five scientific institutions in the developing world. In addition to the Centre of Biotechnology of Sfax, these institutions are the Central Drug Research Institute in Lucknow, India; the Institute of Medicinal Plant Development in Beijing, China; the Malagasy Institute for Applied Research in Antananarivo, Madagascar; and the National Institute of Biodiversity in Santo Domingo de Heredia, Costa Rica. For copies of these profiles, please contact the TWAS secretariat at info@twas.org

"Biotechnology is one of the three major science-related issues that the Ministry of Scientific Research, Technology and Competency Development focuses on. The others are water and information and communication technologies", explains Ahmed Rebai, head of the centre's informatics and bioinformatics service. The Tunisian government also pays a great deal of attention to science and research in general. "Currently nearly 1 percent of the nation's GDP is invested in science and technology, and this figure has been rising steadily", says Ayadi. Tunisia is one of the few African countries to invest this level of funding.

All of this means that institutions like CBS have adequate financial resources. The centre receives up to 70 percent of its annual budget – including money for research projects and core activities – from national government coffers.

"Counterparts in other developing countries constantly complain about a lack of funds and government support. But that's not the case at CBS. "We have enough funding", confirms Ayadi. "It's not a lot, but it's sufficient for our activities."

This funding has enabled the centre to purchase sophisticated equipment. Equally important, it has allowed scientists to focus on their research rather than spending excessive amounts of time seeking external funds. It also means the centre can conduct research that is relevant to the nation's needs. Indeed the government largely commissions research at CBS in alignment with national priorities.

At the same time, the Ministry of Scientific Research, Technology and Competency Development has set standards that both scientific institutes and research projects must meet to ensure that their results are of a high quality and are conducted in the interest of the international scientific community. This is clearly demonstrated by what the centre considers one of its key measures of success: "We are very well known in international networks", notes Ayadi. "We are, in fact, part of three European networks: medical genetics on hereditary hearing loss; devolution of water and soil; and plant agriculture."

Samir Jaoua, head of the Laboratory of Biopesticides, adds: "One of the easiest ways to measure international success is to look at the number of publications in reputable journals. The centre publishes about 45 such papers a year. That is commendable given our size and it is particularly good for an institute in a developing country."

CBS also makes the grade for another international yardstick of scientific success – the creation of intellectual property – and it boasts several national and international patents.



DAVID AND LUCILE PACKARD FOUNDATION

The David and Lucile Packard Foundation was created in 1964 by David Packard (1912-1996), co-founder of the Hewlett-Packard Company, and his wife Lucile Salter Packard (1914-1987). Throughout their lives in business and philanthropy, the Packards sought to use private funds for public good. Guided by the founders' values, the foundation that bears their names supports both people and organizations with the aim of enabling the creative pursuit of science; conserving and restoring the Earth's natural systems; improving the lives of children; and advancing reproductive health. For additional information, see www.packard.org.

In addition, the centre counts the creation of a critical mass of technological expertise among its successes. "In this institute you will find scientists from all fields. You will also find that advanced technologies, such as genetic modification, are routinely carried out in our laboratories", Ayadi points out.

Owing largely to guaranteed government funds and the centre's scientific expertise, CBS has been able to do more than fundamental research. Indeed it has managed to weave its results into the socio-economic fabric of Tunisia. CBS, in fact, is one of the first institutes in either Africa or the Arab region to bridge the gap between research and industry, drawing together the core issues of research, innovation, intellectual property and patenting along the way.

WHAT'S AHEAD

"We have achieved a great deal", Ellouz proudly asserts. "Our research activities show that we have the structure to develop technology", he notes. "Now we need to strengthen our connections with industry even more. We have begun this process, but we need to take additional steps to exert an even greater impact."

The centre's success has also brought new challenges. While praising CBS's ability to build capacity by training young Tunisian scientists, senior researchers say the number of students is growing more quickly than expected. "Perhaps we have too many students for our size", says Gargouri. "If you have more than 30 students in your laboratory, they all require projects and supervision. It is difficult to give enough time to them all. In the future, we may need to focus on fewer students while maintaining or even improving the quality of our research."

Another challenge lies in Tunisia's geographical location, which makes it difficult to obtain equipment or research material as quickly as is desirable. "We don't receive reagents or chemical products as soon as we would like", admits Ayadi. "When I was working in Paris, I would pick up a phone, call and have the item I needed within hours. Here, you can wait days." Gargouri gives an example of a case where one of his students needed to obtain an antibody from Europe. It arrived a year and a half later – too late for the student, who had already written and defended his thesis.

As a beacon of biotechnology in the developing world, CBS's accomplishments could be replicated in other countries, especially in sub-Saharan Africa and the Arab region. Yet, so far there is little success in this area. "It's a mixture of logistics and funding", explains

Ayadi. “Most organizations in Africa don’t have enough funding. It’s also much easier for us to work with Europe, with most countries being just a few hours’ flight away. This is not the case with sub-Saharan Africa, where flight connections are often difficult and time consuming.”

But the centre is not giving up and is committed to continue working on paths that might lead to partnerships with other developing countries – partnerships that will put the benefits of research in biotechnology to work for economic development in the world’s financially poor, but biodiversity rich, countries. “This”, concludes Ayadi, “is our challenge and our dream.”

CBS is one of the first institutes in either Africa or the Arab region to bridge the gap between research and industry.

A CULTURE OF RESULTS

CBS’s organizational framework, featuring separated but integrated laboratories, units and services, allows researchers to concentrate on their particular fields of interest, while also creating a collegial atmosphere where they can share knowledge and ideas, thus stimulating creativity.

Guaranteed government support means scientists need not worry about funding. It also encourages a ‘culture of results’, focused on devising solutions to critical national priorities and forging partnerships with industry and the international scientific community.

CBS – a centre run by an all-African staff – is an excellent example of how advances in biotechnology can tap Africa’s rich biodiversity to improve agricultural productivity, develop products and services of benefit to human health and create new sources of wealth that help foster a more economically secure and prosperous nation. ■

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GROWING FOOD IN URBAN MALAWI

DESPITE ANNUAL ECONOMIC GROWTH RATES THAT HAVE HOVERED AROUND 5 PERCENT OVER THE PAST THREE YEARS, SUB-SAHARAN AFRICA CONTINUES TO BE PLAGUED BY PROBLEMS OF EXTREME POVERTY, FOOD INSECURITY, INADEQUATE HEALTHCARE, ENVIRONMENTAL DEGRADATION AND SUBSTANDARD HOUSING.

The problems of sub-Saharan Africa are largely associated with rural areas that have been the primary targets of aid programmes formulated by national governments, nongovernmental organizations and international funding agencies.

Indisputable factors have driven this concern. With one-third of its population (more than 250 million people) living in rural areas, sub-Saharan Africa remains the world's most rural continent. Over 70 percent of the rural residents, moreover, live on less than US$2 a day.

The scope of sub-Saharan Africa's rural poverty problems should not be underestimated. But there is another trend that also deserves attention: the accelerating pace of urbanization.

Sub-Saharan Africa is not only the world's most rural region; it is also the world's most rapidly urbanizing region. Annual population growth rates in cities have averaged more than 5 percent over the past two decades. If current trends continue, demographers project that the number of urban dwellers in the region will exceed 50 percent of the total population by 2030.

In the following article, David Dalison Mkwambisi, lecturer at the University of Malawi examines urbanization trends in Malawi, one of the world's poorest countries. He suggests that more effective and responsive urban policies that recognize and support urban agriculture could help the nation's urban dwellers do something that initially may seem counterintuitive: grow enough food to feed themselves.

The article is based on a presentation given at the TWAS-United Nations Development Programme's Special Unit for South-South Cooperation (UNDP-SSC)-United Nations University's Institute for Advanced Studies (UNU/IAS) Workshop on Cities, Science and Sustainability held in autumn 2007. The full text will appear in Volume 15 of the TWAS-UNDP/SSC-UNU/IAS 'Sharing Innovative Experiences' series scheduled for publication later this year. For additional information about the article and the series, contact the TWAS secretariat at info@twas.org.

With an average annual per capita income of less than US$600, Malawi is one of the world's poorest countries.

And with an annual urban population growth rate of 4.7 percent, it is also one of the world's most rapidly urbanizing countries.

In 2000, about 1.5 million Malawians, roughly 15 percent of the population, lived in cities. By 2020, some 4 million Malawians, nearly 40 percent of the projected population, will likely live in cities. In addition, by 2020, the nation's two largest cities, Lilongwe in the central region and Blantyre to the south, will each have more than 1.5 million people, three times the number of inhabitants living in each city in 2000.

Food insecurity, poor healthcare, environmental squalor and lack of disposable income among those living in poor communities remain pressing problems in many parts of Malawi. This is especially true in urban centres like Lilongwe and Blantyre. Despite urban agriculture's potential to contribute both to food and economic security, policies to promote urban agriculture have yet to be integrated into overall governmental policies to combat poverty. Indeed urban issues in general remain largely overshadowed by concerns for rural areas in Malawi.

FARMS AND FOOD

A recent survey of households in Blantyre and Lilongwe showed that residents tilling small, often dispersed, plots of land produce on average of 228 kilogrammes (kg) of cereal (or cereal equivalent) per capita. That is 20 percent more than 180 kg per-capita cereal food budget recommended by the Malawi government. The survey, in short, indicates that urban households produce sufficient quantities of food to feed themselves.

However, the survey also reveals wide variations in agricultural productivity among various groups. More educated, wealthier and usually male-headed households consistently enjoy larger harvests than poorer, less educated and often female-headed households.

For example, heads of household, who are illiterate and poor, harvest on average just 92 kg of cereal per capita. Literate and higher income heads of household, in contrast, harvest on average 306 kg of cereal per capita. The same disparity in harvests was recorded for those who had received a post-secondary education compared to those who had obtained only a primary education. Meanwhile, female-headed urban households obtained on average only half the annual output (127 kg per capita of cereal) that male-headed urban households did (265 kg per capita).

As a result, it seems as if two 'types' of farmers engage in urban agriculture in Malawi.

First, there are a group of wealthy, usually male, farmers who generate a moderate portion of their income by selling produce derived from crops grown on relatively large tracts of land averaging some 0.25 hectares. These 'elite' farmers retain the majority of their crop for their own consumption and they often hire seasonal workers to help perform tasks that they would prefer not to do, including marketing whatever produce their families do not consume. Income

By 2020, some 4 million Malawians, nearly 40 percent of the projected population, will likely live in cities.

Agriculture provides a valuable source of food and income for many of Malawi's urban residents.

earned from farming is not critical to their economic well-being and the commercial aspects of their farming are often pursued more as a welcome supplement to their family finances rather than as an absolute necessity.

Second, there are a group of poor, usually female, urban farmers who till smaller tracts, averaging no more than 0.06 hectares, and who consume most but not all of what they produce. For many of these urban farmers, the limited amount of agricultural commodities that they produce beyond what they need for themselves nevertheless serves as a significant source of income. Unlike their richer counterparts, these 'non-elite' farmers sell their excess produce as a matter of economic necessity. Farming for this group is a matter of both food and economic security.

Maize is the primary crop for 'elite' and 'non-elite' farmers alike. Indeed it comprises 30 percent of the total income generated by urban agriculture in Malawi. Greater levels of income could be derived from the sale of livestock and poultry. But these agricultural practices are not common in urban areas. In fact, surveys indicate that only 15 percent of urban farmers in Malawi raise poultry, 6 percent cattle and 2 percent goats or sheep. Nevertheless poorer farmers were found to be more likely to keep livestock largely because they often live in peri-urban areas beyond densely populated urban centres, where land is cheaper and more readily available.

FARMS IN THE CITY

Urban agriculture currently provides a valuable source of food and income for many of Malawi's urban residents, especially the nation's poorest urban residents. Yet its potential for combating food insecurity and extreme poverty remains largely unfulfilled.

The barriers to urban agriculture fall into three broad categories.

First there are barriers posed by the very nature of the urban population. Urban residents are often transitory, and urban areas are often difficult places to develop and sustain effective leadership. That makes it hard for governmental agencies and other institutions to identify urban constituencies and institutions to work with and to develop agricultural policies that are responsive to their needs.

In addition, there are undoubtedly more pressing urban issues than urban agriculture – for example, limited access to safe drinking water, inadequate sanitation, poor education and healthcare, and even food insecurity (which can be addressed by importing food commodities and taking steps to increase crop yields). Each of these issues commands a great deal of attention and resources from governmental agencies, secular nongovernmental organizations (NGOs) and faith-based groups.

Second, not only are urban residents dispersed and transitory. That's also true of urban agricultural tracts,

SHARING INNOVATION EXPERIENCES

Print copies of the TWAS-UNDP/SSC-UNU/IAS series of publications, 'Sharing Innovative Experiences', are distributed upon request (contact info@twas.org). The texts are also available on the internet. To review previous volumes of the series, see tcdc.undp.org/widenew.

which are often small, fragmented and widely distributed plots of land scattered across cities and the surrounding areas. That makes it difficult even for urban advocates in Malawi to deliver services in a cost-effective way.

Third, Malawi's governmental agencies, like governmental agencies in other countries, usually develop technical assistance and economic aid programmes that conform to prevailing national poverty-reduction policies. Historically, that has meant focusing on rural poverty issues. The same mindset drives NGOs and faith-based groups operating at the local and regional levels. Rural issues have historically dominated the poverty-reduction and economic assistance programmes throughout sub-Saharan Africa. That is certainly been the case in Malawi.

MOVING TARGET

Both academic research reports and surveys on the ground strongly indicate that the transitory nature of the urban population hinders the ability of governmental institutions to work in Malawi's cities.

Similar to other countries in the developed and developing world alike, Malawi's urban centres serve as engines for national economic growth. However, these urban centres are often moving forward without the guiding hand of government.

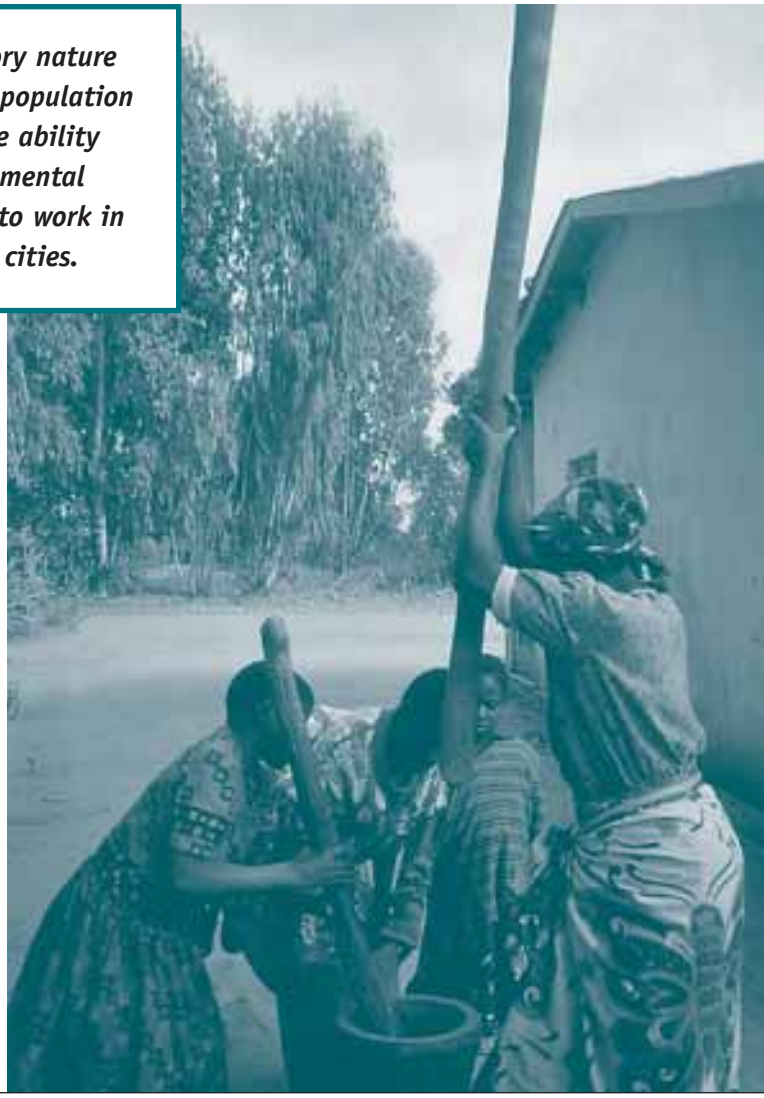
Part of the problem has to do with the rapid pace of growth, which makes it difficult for government to effectively address the challenge. And part of the problem has to do with the creation of 'informal' settlements that operate beyond the reach of conventional laws and regulations related, for example, to building standards, resource use, environmental protection and public health.

These settlements can be built quickly and often within the financial means of the people who live there – in part because they do not have to conform to governmental laws and regulations. But such 'informal' arrangements also make these poorly constructed, vulnerable sites largely invisible when it comes to governmental concerns and funding.

Being below the policy radar screen has its limits and these limits often surface in a precipitous loss of arable land, degraded ecosystems and worsening social and environmental conditions, marked by substandard housing and thread-bare pubic health systems. All of this unfolds in the absence of government involvement.

Poverty and economic insecurity, widespread disease and ill health, and dispersed, often ramshackled housing in Malawi's urban areas not only pose daily risks but also restrict civic participation in poverty-reduction and economic development activities. One critical consequence of the limited presence of urban issues on the policy agenda is that there are few administrative channels for urban farmers to gain information and technical assistance either for agricul-

The transitory nature of the urban population hinders the ability of governmental institutions to work in Malawi's cities.



tural inputs (seeds, fertilizers and pesticides) and/or the marketing of commodities that they are seeking to sell to augment their income.

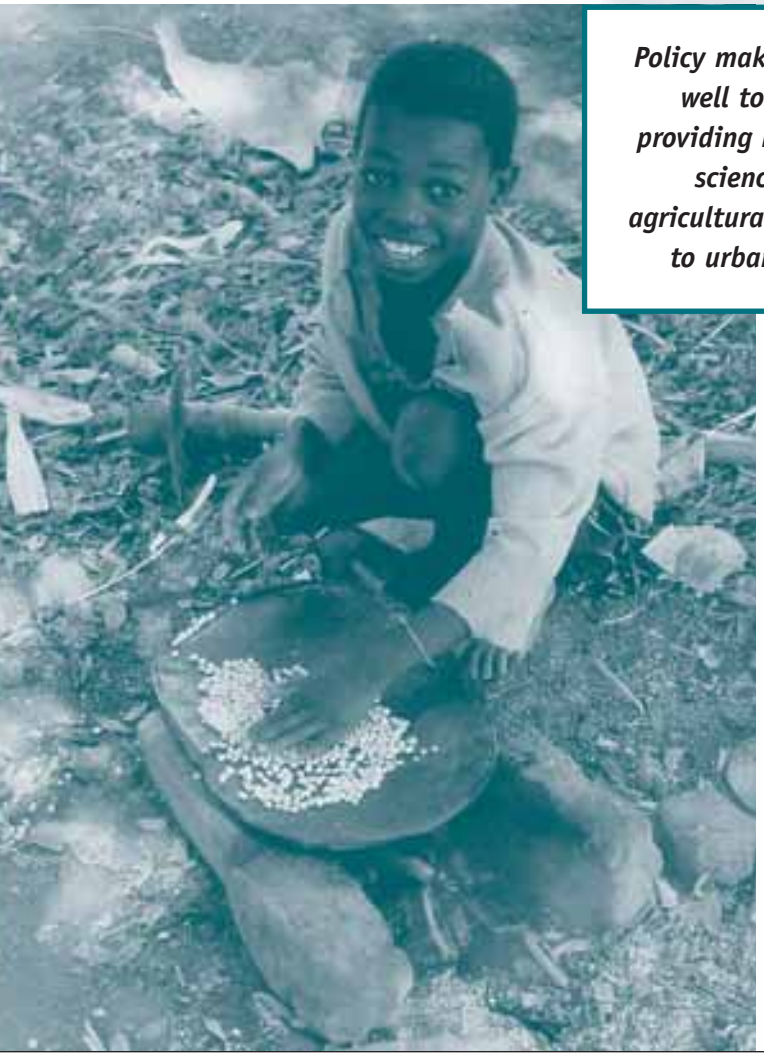
One of the most perplexing issues that makes it difficult for institutions and organizations in Malawi to promote urban agriculture, however, is the nature of urban agriculture itself. Urban agriculture is an activity often undertaken by households with low incomes and with little access either to financial or technical resources.

This predicament makes it difficult for urban farmers to pursue activities to increase crop yields or to take significant steps to diversify their crops to include higher value commodities and livestock. Insecure land tenure (many urban farmers in Malawi are squatters who do not have legal rights to the land) compounds this problem. No one, after all, is likely to make long-term investments in land that he or she may have to abandon at any time. And, even if he or she were interested in doing so, who would provide the money to do it?

A key reform then must be to devise policies that link poor farmers and local community leaders to those with resources and expertise. Effective community leadership will not only foster communications, but it will also allow financial aid and technical support to be channelled to those most in need. This, in turn, will help expand the scope of such activities as urban agriculture, which is capable of addressing both food and economic security issues.

INFORMATION PLEASE

Information currently available to urban farmers in Malawi is largely limited to labels found on the outside of packages containing seeds, fertilizers, pesticides and other agricultural outputs. This information is usually confined to terse, densely worded, guidelines concerning planting procedures and fertilizer and pesticide application rates.



Policy makers would do well to focus on providing high quality, science-based agricultural information to urban farmers.

No one would want to dismiss the importance of this information to the well-being of Malawi's urban farmers. But it is simply not enough. Indeed urban farmers in Malawi receive scant information about broad strategies for pest and disease control, soil conservation, water and waste management and marketing.

Policy makers in Malawi, as a result, would do well to focus on providing high quality, science-based agricultural information to urban farmers. Agribusinesses could also help distribute scientific and technical information beyond that found on product labels. They could, for example, sponsor field days and agricultural fairs dedicated to the exchange of information. These efforts could be held in collaboration with government to help ensure that the information is freely conveyed and not tied to a particular commercial product line owned by the sponsoring corporation.

Similarly, there is a need to regulate street vendors who often serve as the primary suppliers of farm inputs for urban farmers in Malawi, especially the nation's

poorest urban farmers. Governmental agencies, with the help economic development experts, could take a leading role in providing an effective marketing strategy for commodities that urban farmers would like to sell.

Government agencies might also consider empowering farmers to procure inputs as a group or an association directly from suppliers to gain more favourable prices. If devised in conjunction with a technical assistance program, this could prove an effective way of giving farmers timely information on markets, pests and diseases.

Another part of the strategy could focus on creating urban fora to discuss ideas for possible new, more effective policies. The fora should include representatives from governments, nongovernmental organizations, and faith-based groups. The ultimate goal would be to explore potential strategies for reducing urban poverty and promoting urban agriculture.

Government agencies might also consider empowering farmers to procure inputs as a group directly from suppliers.

FOOD AND FAITH

Faith-based institutions, which are among the most trusted and well attended institutions in Malawi, could serve as agricultural distribution centres for urban farmers, helping to ensure the quality of seeds, fertilizers and pesticides. Even more ambitiously, faith-based institutions could serve as vital links between urban agriculture and more broadly based urban poverty reduction initiatives.

This would require convincing governmental agencies that providing resources to faith-based institutions would render effective improvements in urban agricultural practices and that, in turn, would help reduce urban poverty. It would also require church leaders to be willing to broaden their traditional range of activities, which have focused largely on spiritual fulfilment and education. Indeed faith-based institutions have historically shied away from participating in initiatives that seek to generate greater income as their ultimate goal.

This effort, if it were to prove successful, would also require a marriage between the faith-based and scientific communities. The former would provide a valuable 'social bridge' to urban farmers and the communities in which they live. The latter would ensure the reliability of the information that is being conveyed and offer their expertise to expand the scope and depth of new agricultural initiatives.

Such a marriage, if it takes place, would serve as a welcome counterpoint to the often contentious relationship between these two worlds.

Science and religion may not see eye-to-eye on the relationship between faith and reason in society but, nevertheless, they share a common concern for improving the quality of life for all individuals, especially the world's most marginalized and dispossessed citizens. ■

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CONNECT AND COMMUNICATE

TWAS HAS JOINED A CONSORTIUM OF EUROPEAN, AFRICAN AND CARIBBEAN PARTNERS TO PROMOTE COLLABORATIVE RESEARCH PROJECTS IN INFORMATION AND COMMUNICATION TECHNOLOGIES. THE PROJECT, FUNDED BY THE EUROPEAN UNION THROUGH THE SEVENTH RESEARCH FRAMEWORK PROGRAMME, WILL RUN FOR TWO YEARS.

The gulf in access to information and communication technologies (ICTs) between the developed North and the developing South is often called the 'Digital Divide'. Among those countries that lag farthest behind in their access to ICTs are many in sub-Saharan Africa. Most countries in the Caribbean are similarly afflicted. This situation is found not just in access to ICTs, including internet connectivity, but also in the connectivity of research groups in Africa and the Caribbean with their peers in Europe and elsewhere.

Under a new programme funded by the European Union (EU), TWAS and its consortium partners aim to improve the connections between research organizations, first by identifying leading organizations in Africa and the Caribbean in ICT research and development. Consortium partners will then assist these organizations in developing projects with European partners so that they can access some of the millions of euros available for collaborative research under the EU's Seventh Research Framework Programme (FP7).

FP7 is the EU's main instrument for funding research in Europe and will be in place from 2007 to 2013 with a total of budget of €50.5 billion (US$77.4 billion). Some €32 billion (US$49 billion) of the total is earmarked for research cooperation programmes based on 10 key thematic areas, including energy, environment, health and nanotechnology. However, the largest share of the funding is earmarked for ICTs – some €9.1 billion (US$13.9 billion).

Not surprisingly, the bulk of this funding goes to European institutions. However, through FP7, the EU has committed itself to increasing its funding for research to institutions in 'third' countries, including most developing countries and all of sub-Saharan Africa.

A major problem is that researchers in these countries are often unaware of the available funding and the procedures required for answering a call for proposals. In addition, the rules of open competition mean that any proposal submitted by an organization in a developing country is subject to the same evaluation process – and the same grading criteria – as proposals submitted by world-class European laboratories. The chances of success, therefore, are slim.

One way round this is to partner with top European institutions as part of a consortium. It is exactly this sort of partnership – North-South collaboration – that TWAS and its partners are hoping to catalyse in the new "EuroAfriCa-ICT" project.

The origins of the new EuroAfriCa-ICT project can be traced to September 2006, when the EU began funding the project START.

FROM THE START

The origins of the new EuroAfriCa-ICT project can be traced to September 2006, when the EU began funding the project, 'Developing a strategic research and development partnership between the EU and Africa in the ICT field', also known by the acronym 'START' or as EuroAfrica-ICT, through its Sixth Framework Programme (FP6).

Under START, three consortium partners (Orionis, France; the Meraka Institute, South Africa; and the Panos Institute West Africa, Senegal) organized a series of regional workshops in Africa as well as 'concertation' meetings in Brussels. The regional workshops in Africa, held in Botswana, Cameroon, Ghana, Kenya, Senegal and South Africa, were designed to raise the awareness of African scientists to the possibilities of EU funding and collaborative projects in the ICT field. On the other hand, concertation meetings in Brussels were designed to highlight, for both European and African organizations and research institutions, ICT initiatives currently being carried out in Africa (see box, page 39).

One measure of the programme's success is the number of organizations that have attended these meetings. Envisaged to involve around 30 participants, more than 100 people attended the latest meeting held in January 2008. A website developed under the auspices of the project (*www.EuroAfrica-ICT.org*) receives more than 1,000 hits per month.

In addition, under START, an open consultation was held to help define a framework document on the development of science and technology cooperation between the EU and sub-Saharan Africa in the ICT sector, taking into account the experience, ideas and suggestions of the research and ICT communities in Europe and sub-Saharan Africa.

TWAS brings to the consortium the strength of its membership and its networks.

This consultation document, available on the START website, led to the production of a 'manifesto' that has been endorsed by a large number of European, African and global organizations. The EuroAfrica-ICT manifesto recommends that, in the ongoing revision process of the EU's FP7 ICT work programme, the strategic nature of EU-Africa cooperation should be given more significance by providing opportunities in future calls for proposals for so-called Specific International Cooperation Actions (SICAs).

EUROAFRICA-ICT

Building on the achievements of START, a new project, EuroAfriCa-ICT, has been launched with six additional partners, including TWAS (see box, page 37). Among the other five new members, the Kigali Institute of Science and Technology (KIST), Rwanda, and Makerere University, Uganda, bring local expertise in ICT research and training. Organizations such as the Association of Commonwealth Universities (ACU) and *Agence universitaire de la francophonie* (AUF) add comprehensive networks of higher education institutions in Africa to the consortium's strengths. Likewise, TWAS brings to the consortium the strength of its membership and its networks of research institutions and their expertise in the developing world.

The final consortium partner is the Caribbean Academy of Sciences (CAS). The inclusion of CAS will allow the project to reach beyond Africa and into the Caribbean – another area of interest to the EU that is eligible for support under FP7. The inclusion of the Caribbean also helps to explain the subtle change in the project's name, from EuroAfrica-ICT to EuroAfriCa-ICT – the 'Ca' providing the reference to the Caribbean.

MOVING ON

So what does this new and expanded consortium hope to achieve? And how are the project goals different from the previous project?

PROJECT PARTNERS

The consortium implementing the EuroAfriCa-ICT project is composed of nine partners:

- *TWAS, the academy of sciences for the developing world.*
- *Orionis, a division of Sigma Consultants, based near Nice, France, manages and implements several international science and technology cooperation programmes in ICT. Orionis' managing director, Karine Valin, Orionis acted as the project coordinator for START and will do so again for EuroAfriCa-ICT. See: www.orionis.com.*
- *The Panos Institute West Africa (PIWA), Senegal, was one of the original partners in the START project. PIWA is an international nongovernmental organization that serves west and central Africa and is dedicated to promoting the use of media and communication as strategic tools for change, social justice and development. See www.panos-ao.org.*
- *The Meraka Institute, Council for Scientific and Industrial Research (CSIR), South Africa, was another of the original partners in the START project. The vision of Meraka, which means 'common grazing ground' in the local language, is to be "the ICT digital commons in Africa and for Africa". It focuses on technology research, applications and innovations and human capital development. See www.meraka.org.za.*
- *The Association of Commonwealth Universities (ACU), based in London, United Kingdom, is the world's oldest inter-university network. Some 500 universities across the Commonwealth are members. The Africa Unit of the ACU was established with support from the UK government in 2006 to carry forward the recommendations of the report of the Commission for Africa and the Group of 8 Gleneagles communiqué in the field of higher education partnerships, particularly with regards to science and technology, and is the coordinating partner in the FP7-funded EU-Africa science and technology dialogue platform, 'CAAST-Net'. See www.acu.ac.uk and www.caast-net.org.*
- *The Agence universitaire de la Francophonie (AUF), a global network of 659 higher education and research institutions with many members in francophone Africa. See www.auf.org.*
- *The Kigali Institute for Science and Technology (KIST), Rwanda. Founded in 1997, the remit of KIST is to build human capacity through advanced training. The relatively young institution is currently building its research capacity in a number of areas, including ICTs. See www.kist.ac.rw.*
- *Faculty of Computing and Information Technology (CIT), Makerere University, Uganda, provides training, research and consultancy services in computing, ICT and other related fields. It runs undergraduate, master's and doctoral programmes in many areas of computer science and information technology and is currently formulating its research agenda. See www.cit.ac.ug.*
- *The Caribbean Academy of Sciences (CAS), was inaugurated in 1988 as an independent, nongovernmental body aiming to provide a forum for interchange among scientists on important issues related to the application of science and technology to development and serve as a source of advice to regional, governmental and non-governmental organizations in scientific and technology matters. See www.caswi.org.jm.*

In addition, Thierry Devars, policy officer, DG InfSo, will oversee the project on behalf of the European Union.



In many ways, the aim is similar to the START project. Regional workshops will be held in Africa to explain and promote funding opportunities under FP7 and to identify leading African and Caribbean ICT research organizations. These organizations will then be brought into contact with European organizations to establish partnerships that can lead to successful proposals.

Under EuroAfriCa-ICT, workshops will be held in South Africa in June, and later on in Benin, Rwanda, Uganda and – for the Caribbean region – Jamaica. The plan is to hold two of these workshops in October 2008, which should coincide with the next EU call for proposals in the ICT area. In November, the call is expected to announce available funding in the region of €1 billion (US$1.5 billion). The other workshops will be held early in 2009, before the deadline of the call for proposals. This will provide ample opportunities for all target institutions to find consortium partners and develop competitive proposals.

Regional workshops will be held in Africa to explain and promote funding opportunities under FP7.

Previous EuroAfrica-ICT meetings during the START project successfully brought together national, regional and international organizations with institutions involved in ICT research and development, including representatives from the private sector. These meetings, held in Brussels, will continue – and hopefully expand – under the new EuroAfriCa-ICT. They will not only provide opportunities for networking and the development of research consortia, but also alert African and European organizations to the latest information and opportunities afforded by the EU.

EU-AFRICA SUMMITS

The new, more ambitious EuroAfriCa-ICT project, however, will go beyond the START project by organizing two international summits.

These summits are planned to be high-level meetings with participation by African and EU ministers of science and technology or other relevant ministries, as well as European commissioners and high-level representatives from the Directorate-General 'Information Society' (DG InfSo) and other directorates-general.

The aim of the summits is to expand the dialogue between the European and African ICT communities and the authorities of both regions. Each summit will last two days and will likely include high-level presentations, research and development awareness-raising sessions, round-table discussions, and opportunities for networking and identifying partners. Some 200 delegates are expected to attend each summit, including ICT experts from Europe, Africa and the Caribbean, policy- and decision-makers, heads of stakeholder institutions and international organizations, as well as repre-

sentatives from each of the EuroAfriCa-ICT partner organizations.

The First EU-Africa ICT Summit is scheduled to take place in November 2008 in Lyon, France, with the date and location chosen to link in with the 'ICT Event' on 25-27 November, a major EU-organized meeting that will be attended by representatives of many ICT-based private sector industries as well as decision-makers and researchers (see *ec.europa.eu/information_society/events/ict/2008/index_en.htm*).

The Second EU-Africa ICT Summit, which will follow the format of the first summit, is scheduled to take place in South Africa in late 2009.

"The ultimate objective of the EuroAfriCa-ICT project", confirms Roger Torrenti, head of Orionis and EuroAfriCa-ICT project advisor, "is to help develop concrete and ambitious cooperative projects in the field of ICTs between European partners and researchers in Africa and the Caribbean. We also hope that, at the end of the two-year project, all the consor-

AFRICA CONNECTED

For the past few years, GÉANT, a European Union-funded initiative designed to connect national research and education networks across Europe, and its follow-on initiative, GÉANT2, has connected scientists in some 34 European countries with their peers in North America, Latin America, China, India, southeast Asia and the Mediterranean region. Until now, sub-Saharan Africa, with the exception of South Africa, was not connected to the network.

On 31 January 2008, the same day as a EuroAfrica-ICT concertation meeting in Brussels, it was announced that a major step had been taken to reduce this Digital Divide.

The aim of the UbuntuNet Alliance, founded in 2005, is to establish a research and education network backbone for sub-Saharan Africa, initially through a series of National Research and Education Networks (NRENs). These NRENs, that include Kenya, Malawi, Mozambique, Rwanda, South Africa, Sudan, Tanzania, Uganda and Zimbabwe, are now connected to GÉANT2 through the UbuntuNet Alliance's hub in London. The new link – operating at one Gigabyte per second – builds on a connection between South Africa and Europe and extends the benefits of collaboration to researchers and scholars across sub-Saharan Africa.

"Research today is truly global", said Viviane Reding, European Commissioner for Information Society and Media. "Bringing together the best minds from Africa and Europe is not only beneficial for science, but for all citizens of the world that today depend increasingly on technology, innovation and collaborative research."

tium partners will be involved in some strategic projects between Africa, the Caribbean and the EU."

Mohamed Hassan, TWAS executive director, adds: "Encouraging North-South cooperation between individual scientists and centres of research and scholarship has long been one of the principal objectives of TWAS. In recent years, however, the academy has focused largely on South-South cooperation – for example, through the implementation of our fellowships programmes with Brazil, China, India and Pakistan. The new EuroAfriCa-ICT project will allow us to redress the balance somewhat – at least in the field of ICTs – and help bring much needed expertise, and hopefully funding, within the reach of African and Caribbean institutions. The excellent quality of TWAS's partners in the consortium bodes well for the success of the project and the ongoing development of science in the South." ■

For additional information, see:
www.euroafrica-ict.org
or contact:
Karine Valin, Orionis: karine.valin@euroafrica-ict.org
Peter McGrath, TWAS: mcgrath@twas.org.

DISEASE AND MORTALITY IN AFRICA

WIDESPREAD DISEASE AND HIGH RATES OF MORTALITY HAUNT AFRICA MORE THAN ANY OTHER CONTINENT. WHILE POVERTY AND INADEQUATE HEALTHCARE SYSTEMS LIE AT THE HEART OF THE CONTINENT'S HEALTHCARE WOES, THE SPREAD OF INFECTIOUS DISEASES – BOTH LONG-STANDING AND EMERGING – OFTEN SERVE AS THE MOST IMMEDIATE CAUSE OF ILLNESS AND DEATH. PETER MCGRATH, TWAS'S ACTING PROGRAMME OFFICE, PROVIDES A DETAILED PORTRAIT OF THE HEALTHCARE CHALLENGES THAT LIE AHEAD FOR THE WORLD'S POOREST CONTINENT.

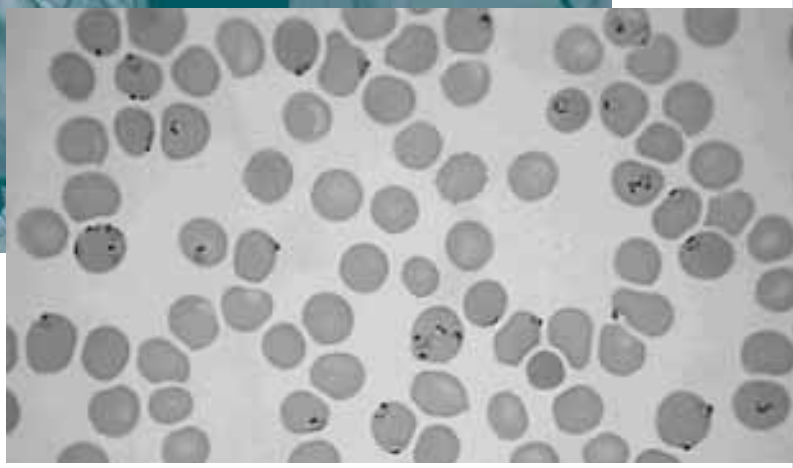
Some 90 percent of all malaria deaths in the world today occur in sub-Saharan Africa. An estimated one million people in Africa die from malaria each year. Children under 5 years old are particularly at risk.

More than 26.5 million Africans currently live with HIV/AIDS. In the worst affected African nations, HIV/AIDS causes an estimated 20 to 40 percent of adult deaths.

Africa is home to nine of the 10 countries with the highest per capita rates of tuberculosis. The global fatality rate for TB is less than 25 percent. In African countries with high HIV-infection rates (TB is a common complication in patients suffering from HIV/AIDS), the TB fatality rate sometimes exceeds 50 percent.

In sub-Saharan Africa, grim statistics on the state of public health are so staggering that they often prove difficult to comprehend. And it's the spread of infectious diseases that often provide the most shocking indication of the depth of this human tragedy.

It's little wonder, then, that health experts studying public health in Africa commonly refer to malaria, HIV/AIDS and TB as the 'big three'.



MORE THAN THREE

Beyond the 'big three', Africa is beset by numerous so-called 'neglected diseases' – a group of tropical infections that are especially endemic in low-income populations in developing nations. Together, the neglected diseases cause an estimated 500,000 to 1 million deaths annually and trigger a global disease burden equivalent to that of HIV/AIDS. Compared to the 'big three', however, 'neglected' diseases often attract much less media attention and research funding. These diseases include:

- Trypanosomal parasites: Kala-azar (visceral leishmaniasis), sleeping sickness (African trypanosomiasis).
- Helminth (worm) parasites: Schistosomiasis, lymphatic filariasis (causes elephantiasis), onchocerciasis (river blindness), drancunculiasis (guinea worm), ascariasis (roundworm), trichuriasis (whipworm) and hookworm.
- Bacterial infections: Leprosy, Buruli ulcer, trachoma (an eye disorder), cholera.
- Viral infections: Yellow fever, dengue fever, Japanese encephalitis – all caused by mosquito-born flaviviruses.

In a guest editorial published in the first issue of the open access journal, *PLoS Neglected Tropical Diseases*, Margaret Chan, World Health Organization (WHO) director-general, noted: "These diseases", which are both a symptom and cause of Africa's widespread malaise, "frequently overlap geographically. They tend to cluster in places where housing is substandard, drinking water is unsafe, sanitation is poor, access to health care is limited or non-existent, and insect vectors are constant household and agricultural companions."

Despite the havoc that they wreak, neglected diseases provide some examples of how concerted action to tackle a health problem can benefit sustainable development. An international effort to control river blindness, for example, has helped treat 40 million people in 16 countries, while another has helped reclaim 25 million hectares of abandoned arable land

that now provides food for 17 million people a year. The economic return of these projects is estimated to be about 20 percent.

POVERTY AND ILL-HEALTH

The challenges posed by specific diseases are complicated by challenges linked to poverty and associated incidences of environmental degradation.

Patients suffering from such water-related diseases as malaria, diarrhoea and trachoma occupy about half of all hospital beds in the world and unsafe drinking water and poor sanitation kill some 4000 children each day. Sub-Saharan Africa, moreover, is particularly

vulnerable to conditions of water scarcity and pollution.

Such dire figures highlight the enormity of the challenge faced by those who advocate that universal access to safe drinking water is a basic human right.

Statistics published in 2006 by the United Nations Food and Agriculture Organization (FAO) indicate there are 820 million chronically hungry people in developing countries – some 212 million live in India and another 206 million in sub-Saharan Africa. More than four million children under five die each year in sub-Saharan Africa; malnutrition is a contributing factor in about half of these deaths. Severely malnourished children are eight times more likely to die before their fifth birthday than those who are well nourished. Such figures are difficult to comprehend, especially when considering Africa's treasure trove of biodiversity (including food crops) and natural resources.

> ***'Neglected' diseases often attract much less media attention and research funding.***

Little or no access to adequate healthcare facilities also takes its toll among the African population. In sub-Saharan Africa, child mortality rates average 172 deaths per 1,000 babies born compared to 9 per 1,000 in developed regions. Diarrhoea ranks as a major cause of death among children under five. In addition, many babies die in their first month of life due to pregnancy and labour complications or from infections.

Recent estimates suggest that nearly two-thirds of deaths in children under five could be prevented by providing children with access to a few known and effective medical interventions (for example, vaccines for pneumococcus and rotavirus, zinc therapy for diarrhoea, and insecticide-treated bed nets) to control malaria, clean water and improved sanitation. But such efforts are stymied by the continent's impoverished healthcare systems. Some 80 percent of the victims die at home without ever seeing a healthcare provider. Just 266 doctors, for example, serve Malawi's 10 million people.

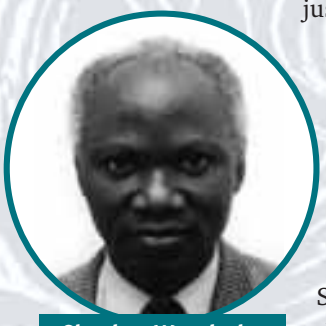
BUILDING SCIENTIFIC CAPACITY

All these challenges are closely linked with underdevelopment and disproportionately affect the world's poorest countries. Because many countries in sub-Saharan Africa are poor, they have traditionally failed to invest in their national science and technology capacities.

Today, however, scientific capacity is increasingly being recognized as an essential prerequisite for sustainable economic development. In a 2007 meeting of African Union (AU) countries, heads of government pledged to increase their spending on science and technology to 1 percent of their gross domestic product (GDP). Such pronouncements have been made many times before, dating back, for example to the United Nations Conference on Science and Technology in 1979 held in Vienna. But this time political determination seems to be matching the rhetoric and several countries, including Ghana, Rwanda, Senegal, South

Berhanu Abegaz

Peter Mugyenyi



Charles Wambebe

Africa, Tanzania and Uganda have taken promising steps in this direction.

TWAS has identified 80 countries that are seriously lagging in S&T capacity. Most are in sub-Saharan Africa. An analysis of the number of scientific publications confirms that not only is there a North-South gap in the creation of scientific knowledge, but that there is also a distinct South-South gap.

For example, in recent years, countries in the developed North have been responsible for some 78 percent of all scientific publications, compared to just 22 percent of publication produced by the South. Yet it is also important to note that 80 developing countries account for just 3 percent of this 22 percent (amounting to 0.66 percent of global output).

As this statistic shows, knowledge is not simply concentrated in the North but it is also concentrated among a distinct minority of countries in the South. When it comes to authorship in scientific publications, many developing countries continue to be left behind and many of these countries are in sub-Saharan Africa.

Despite the low number of publications emanating from Africa, there are some excellent scientists working on the continent – many of them in the medical sciences. To highlight just four (all of whom have been elected as TWAS Fellows):

- Berhanu Abegaz (University of Botswana, Botswana): Studies the phytochemistry of African plants with the aim of identifying natural products that can be used to develop pharmaceuticals. He has identified molecules that are used to treat everything from tapeworms to malaria.
- Thomas Egwang (Med Biotech Laboratories, Uganda, and now executive director of the African Academy of Sciences): Studies molecular parasitology, focusing on such diseases as malaria and river blindness.
- Peter Mugyenyi (Joint Clinical Research Centre (JCRC), Kampala, Uganda): HIV/AIDS control programmes instigated by Mugyenyi and staff at the JCRC have helped reduce the percentage of adults carrying the HIV virus in Uganda from some 15 percent in 1991, when JCRC was founded, to just over 6 percent today.

- Charles Wambebe (Institute of Biomedical Research in Africa, Nigeria): A neuropharmacologist with interests in developing pharmaceuticals from African plants. Through his efforts, *Nicosan*, a treatment for sickle cell anaemia, has recently been commercialized and is available in Africa and the United States.

TWAS has identified 80 countries that are seriously lagging in S&T capacity.

The combined expertise of these and other eminent scientists that have been elected members of TWAS allows TWAS to act as the "Voice of science for the South

TWAS's ultimate goal is to see (indeed help build) a world in which scientists in the South have access to state-of-the-art laboratories and the latest scientific literature. This will enable them to work on critical issues relevant to their home countries' development

challenges and ultimately to work collaboratively with scientists in the North in terms of the excellence of their research.

CHALLENGES AHEAD

The challenges facing the African continent is immense and can only be tackled if all stakeholders – policy-makers, international donors, scientists in universities and research centres, healthcare providers and non-governmental organizations – work together towards a series of targets, such as those laid out in the Millennium Development Goals (MDGs).

Among the MDGs, which were agreed by the world's heads of state in 2000, are ambitions such as eradicating extreme poverty and hunger, reducing child mortality, improving maternal healthcare and combatting infectious diseases.

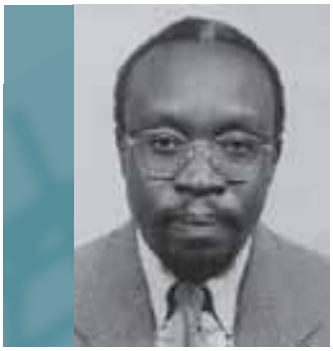
Together, the activities of TWAS and its partner organizations in Trieste, including the Third World Organization for Women in Science (TWOWS), the InterAcademy Panel (IAP) and the InterAcademy Medical Panel (IAMP), are making a small but significant difference in the fight against disease and mortality in Africa and the realization of the MDGs. The presence and impact of these organizations – both individually and collectively – is expected to continue to grow in the international scientific, economic development and policy communities.

That's good news for Trieste. But that's even better news for improving the health and well-being of poor people across the globe. ■

Peter McGrath
Acting Programme Officer
TWAS
Trieste, Italy
mcgrath@twas.org

AAS EXECUTIVE DIRECTOR

• **Thomas Egwang** (TWAS Fellow 1997) has been appointed the executive director of the African Academy of Sciences in Nairobi, Kenya. Egwang previously served as director general and scientific director of Medicine and Biotechnology Laboratories in Kampala, Uganda. He is vice chair of the National Biosafety Committee of the National Council for Science and Technology (UNCST), in Uganda; a board member of the Uganda National Council for



Thomas Egwang

Science and Technology (UNCST); and a member of several steering committees at the World Health Organization (WHO), in Geneva, Switzerland. Earlier in his career, he was research director at the *Centre Internationale de Recherches Medical de Franceville* (CIRMF), in Gabon. Egwang was the first Ugandan scientist to be selected an International Research Scholar by the Howard Hughes Medical Institute, in Maryland, USA, and is a recipient of a WHO Career Development Award.

INSA PRESIDENT

• **Mamannamana Vijayan** (TWAS Fellow 2001) has succeeded **R.A. Mashelkar** (TWAS Fellow 1993) as president of the Indian National Science Academy (INSA). Vijayan is

Mamannamana Vijayan

an honorary professor and distinguished biotechnologist at the Indian Institute of Science (IISc) in Bangalore, India. He obtained a PhD from IISc and was a postdoctoral student at Oxford. He returned to India in 1971, where he has worked in a variety of capacities over the past three decades. Vijayan is a fellow of all three national science academies of India. For his distinguished work in molecular biology, he has been awarded numerous honours, including the SS Bhatnagar Prize, GN Ramachandran Medal of INSA, FICCI Award for Life Sciences, Om Prakash Bhasin Award, Padma Shri and the first CSIR/Science Congress GN Ramachandran Award for Excellence in Biological Science and Technology. Mashelkar was president of INSA for three years, during which time the Academy successfully expanded the scope of

R.A. Mashelkar

the Academy's activities, most notably in such critical areas as science education, disaster response and policy-making and international cooperation.

JAMIL RECOGNIZED

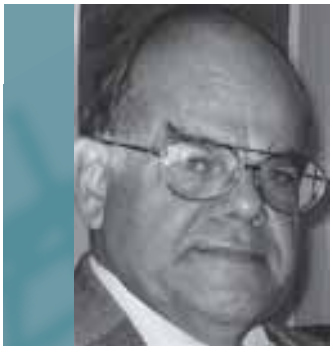
• **Kaiser Jamil**, president of the Third World Organization for Women in Science (TWOWS), has been named one of the top twenty women achievers in the Indian healthcare industry by the journal *Modern Medicare* (vol. 4, no. 4, 2008). Jamil, whose current research interests focus on molecular and computational biology and pharmacogenomics, is research director at the Indo American Cancer Institute and Research Centre and managing director of the Gene Expression, Training and Research Institute (GETRIB) for bioinformatics, both in Hyderabad, India. She is also general secretary for the All

Kaiser Jamil

India Biotech Association (AIBASC), a task force member in the Department of Biotechnology, New Delhi, and an advisor to the Union Public Service Commission (UPSC), also in New Delhi. Jamil has written two books and more than 170 journal articles, and has edited several conference proceedings.

ALLENDE HONOURED

• The French Academy of Science and the *Ecole Nationale Supérieure des Mines de Saint-Etienne* has awarded **Jorge Allende** (TWAS Fellow 1985) the 2007 PuRkwa Prize. Allende, professor at the Institute of Biomedical Sciences (ICBM) in the Faculty of Medicine and Research at the University of Chile, is being honoured for his innovative and tireless promotion of scientific literacy. He shares the award with Stevan Jokic of the Vinca Institute of Nuclear Sciences in Belgrade, Serbia. Allende is director of the Inquiry based Science Education Program (ECBI), a joint initiative of the Chilean Academy of Sciences, Chile's Ministry of Education and the University of Chile, and coordinator of the Science Education Program of the Inter American Network of Academies of Sciences (IANAS) and the Inter Academy Panel (IAP). His other honours include an honorary doctorate from the University of Buenos Aires and the Grand Cross of Scientific Merit, Brazil.



Jorge Allende

BECQUEREL BEQUEATHED

• **Syed M. Qaim** (TWAS Fellow 2001) was awarded the 2008 Becquerel Medal by the Royal Society of Chemistry, London, in recognition of his contributions to radiochemistry. Qaim is advisor at the Institute of Nuclear Chemistry, Research Centre, Jülich; professor at the University of Köln; honorary professor at Government College University, Lahore; chief editor of *Radiochimica Acta*; and chair of the International Nuclear Data Committee at the International Atomic Energy Agency (IAEA). In recognition of his work in nuclear chemistry, Qaim has also received several other awards, including the Eötvös Medal and Honorary Fellowship by the Hungarian Physical Society; honorary citizenship and honorary doctorate by Debrecen University in Hungary; the Medal of Honour by the Egyptian Atomic Energy Authority; and the Sitara-i-Imtiaz of Pakistan.

Syed M. Qaim

OARE EXPANSION

• Launched in 2006 and recently exanded to include an additional 37 developing countries, the Online Access to Research in the Environment (OARE), an international public-private partnership comprised of Yale University, the United Nations Environment Programme (UNEP), the MacArthur and Hewlett foundations and 300 scientific societies and associations, now provides 100 developing countries free online access to more than 1,300 peer-reviewed journals in the natural and environmental sciences. For additional information, see: www.oaresciences.org.

IN MEMORIAM

• **Ernesto Illy** died on 3 February 2008 at age 82. He was the son of Francesco Illy, founder of illycaffè, the Trieste-based coffee manufacturer and sponsor of the Trieste Science Prize. The prize was launched in 2005 as a cooperative initiative of illycaffè and TWAS designed to honour the most eminent scientists in the developing world. Ernesto Illy earned his PhD in chemistry at the University of Bologna. He became managing director of illycaffè following his father's death in 1956 and chairman of the company in 1963. Under his direction, the company continued to expand its international reach, emerging as the world's preeminent manufacturer and distributor of fine coffee. Today illycaffè is sold in coffee bars, restaurants and food stores in 140 countries. Illy also established the world's first coffee university in Naples, Italy, in 1999. A second coffee university followed in São Paulo, Brazil, in 2000. Nicknamed "the espresso evangelist", he founded and served as a leading member of many scientific associations and trade organizations concerned with coffee research and promotion.

Ernesto Illy

WHAT'S TWAS?

TWAS, the academy of sciences for the developing world, is an autonomous international organization that promotes scientific capacity and excellence in the South. Founded as the Third World Academy of Sciences by a group of eminent scientists under the leadership of the late Nobel Laureate Abdus Salam of Pakistan in 1983, TWAS was officially launched in Trieste, Italy, in 1985, by the Secretary General of the United Nations.

TWAS has more than 850 members from 90 countries, 73 of which are developing countries. A 13-member Council is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a secretariat, headed by an Executive Director and located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is responsible for the administration of TWAS funds and staff. A major portion of TWAS funding is provided by the Italian government.

The main objectives of TWAS are to:

- Recognize, support and promote excellence in scientific research in the South.
- Provide promising scientists in the South with research facilities necessary for the advancement of their work.
- Facilitate contacts between individual scientists and institutions in the South.
- Encourage South-North cooperation between individuals and centres of science and scholarship.

In 1988, TWAS facilitated the establishment of the Third World Network of Scientific Organizations (TWNSO), a non-governmental alliance of some 150 scientific organizations in the South. In September 2006, the foreign ministers of the Group of 77 and China endorsed the transformation of TWNSO into the Consortium on Science, Technology and Innovation for the South (COSTIS). COSTIS's goals are to help build political and scientific leadership in the South and to promote sustainable development through broad-based South-South and South-North partnerships in science and technology. **costis.g77.org**

TWAS also played a key role in the establishment of the Third World Organization for Women in Science (TWOWS), which was officially launched in Cairo in 1993. TWOWS has a membership of more than 2,500 women scientists from 87 developing countries. Its main objectives are to promote research, provide training, and strengthen the role of women scientists in decision-making and development processes in the South. The secretariat of TWOWS is hosted and assisted by TWAS. **www.twows.org**

Since May 2000, TWAS has been providing the secretariat for the InterAcademy Panel on International Issues (IAP), a global network of 98 science academies worldwide established in 1993, whose primary goal is to help member academies work together to inform citizens and advise decision-makers on the scientific aspects of critical global issues. **www.interacademies.net/iap**

The secretariat of the InterAcademy Medical Panel (IAMP), a global network of 65 medical academies and medical divisions within science and engineering academies, relocated to Trieste in May 2004 from Washington, DC, USA. IAMP and its member academies are committed to improving health worldwide, especially in developing countries.

www.iamp-online.org

WANT TO KNOW MORE?

TWAS and its associated organizations offer scientists in the South a variety of grants and fellowships. To find out more about these opportunities, check out the TWAS website:
www.twas.org

FELLOWSHIPS

Want to spend some time at a research institution in another developing country? Investigate the fellowships and associateships programmes:
www.twas.org/Exchange.html
TWOWS offers postgraduate fellowships to women from least developed countries (LDCs) and other countries in sub-Saharan Africa:
www.twows.org/postgrad.html

GRANTS

Are you a scientist seeking funding for your research project? Then take a look at the TWAS Research Grants scheme:
www.twas.org/mtm/RG_form.html
Is your research group seeking additional funds? See if it is eligible to apply under the TWAS Research Units in Least Developed Countries programme:
www.twas.org/mtm/research_units.html

EQUIPMENT

But that's not all TWAS has to offer. For instance, do you need a minor spare part for your laboratory equipment – no big deal, really – but you just can't get it anywhere locally? TWAS can help:
www.twas.org/mtm/SP_form.html

TRAVEL

Would you like to invite an eminent scholar to your institution, but need funding for his/her travel? Check out the Visiting Scientist Programme:
www.twas.org/hg/vis_sci.html

CONFERENCES

Are you organizing a scientific conference and would like to involve young scientists from the region? You may find the help you need here:
www.twas.org/mtm/SM_form.html