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Since the reinstatement of civilian government in 1999, Nigeria has launched a broad-based effort to build a vibrant economy, placing increasing emphasis on science and technology to achieve this goal.

The Ministry of Science and Technology, which oversees the work of 48 research institutes and centres, is mandated to maintain and develop excellence in science, engineering and technology, and to maximize the contributions of each field to sustainable economic development in Nigeria.

Nigeria's Science-Based Plans for Development

To fulfill these goals, the ministry has sponsored a series of interrelated programmes designed to lay a strong foundation for sustained socio-economic growth. The overall objectives of these programmes are to:

- *Reduce poverty and promote wealth creation.*
- *Boost food production and ensure food security.*
- *Stabilize the national currency, lessen demand for foreign exchange and reduce capital flight.*
- *Support universal basic education, especially efforts that encourage scientific literacy and the development of technical skills.*

Two technologies, in particular, will play a critical role in Nigeria's efforts to establish an enduring base for sustained social and economic development: information technology and biotechnology.

Development and application of information technologies in an efficient, reliable and affordable manner sets the stage for social and economic growth in a host of other sectors, including education, health, agriculture, manufacturing and services. Development and application of information technologies have the added benefit of fostering pan-African cooperation, on the one hand, and integrating Africa into the global economy, on the other hand.

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As a result, the government of Nigeria envisions the development and application of information technologies as the fountainhead of all national efforts to promote science-based development. Initiatives to improve the nation's phone systems and internet services, through public and private investment, are at the forefront of our economic and social reforms.

Similarly, development and application of biotechnology are essential for advancing a diverse set of critical social and economic development goals, including boosting food production, improving health-care delivery, and even enhancing mining operations. Because the development of biotechnology does not take place in a vacuum, but often draws on local plant resources and indigenous knowledge, it can also play a valuable role in efforts to reduce poverty and protect the environment. Like information technologies, biotechnology impacts a wide range of factors that feed into development, thereby making investments in biotechnology a critical aspect of Nigeria's overall science-based development plans.

While Nigeria is committed to building its domestic capacities in information technologies and biotechnology, it does not plan to assume this task solely on its own.

The nation, in fact, is actively involved both in bilateral and multilateral science and technology initiatives and collaborative research and development activities that involve foundations, national and international aid organizations, private research and development firms, and grassroots organizations.

To advance our overall goals and strengthen our partnerships, this spring the government of Nigeria announced the formation of an international scientific advisory council. The council, which is chaired by Mohamed H.A. Hassan, executive director of TWAS and president of the African Academy of Sciences, includes six of the developing world's most respected scientists and science administrators: Alexander E.O. Animalu, president, Nigerian Academy of Sciences; Turner T. Isoun, Nigerian minister of science and technology; Balkumar Marthi, principal scientist, Hindustani

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Lever Research Centre, India; G.O.P. Obasi, secretary general, World Meteorological Organization, Switzerland; and Thomas R. Odhiambo, founder and honorary president, African Academy of Sciences. Ulf Pettersson, professor of genetics and pathology, Uppsala University, Sweden, has also agreed to join the council.

Beyond advising the president on critical science and technology issues, the council will seek to:

- *Encourage Nigerian scientists, who are now part of the African diaspora, as well other scientists and scientific administrators in international organizations, governmental agencies, and private research and development firms, to help build Nigeria's capacities in science and technology.*
- *Provide Nigeria's science and technology communities with information about potential funding opportunities and keep research and development communities outside of Nigeria informed about potential investment opportunities within Nigeria.*
- *Promote inter-African co-operation and integration through effective applications of science and technology that are important to the continent as a whole. To advance this goal, the government of Nigeria has approved a grant of US$5 million to the African Academy of Science's endowment fund. The Nigerian government will encourage other African governments to contribute to the fund as well.*

Science and technology have been the primary drivers of progress throughout the 20th century. For too much of the time, Africa watched as other continents enjoyed the fruits of their intellectual and financial commitments to science-based development.

Africa could ill afford to be an idle spectator then and it certainly cannot afford to be an idle spectator now as the pace of change, spurred by science and technology, is accelerating at an unprecedented rate. The initiatives outlined above are designed to nudge Nigeria's scientific and technological community back into the science and technology arena. I strongly urge other African governments to join me in this effort. ■

Chief Olusegun Obasanjo
President
Federal Republic of Nigeria

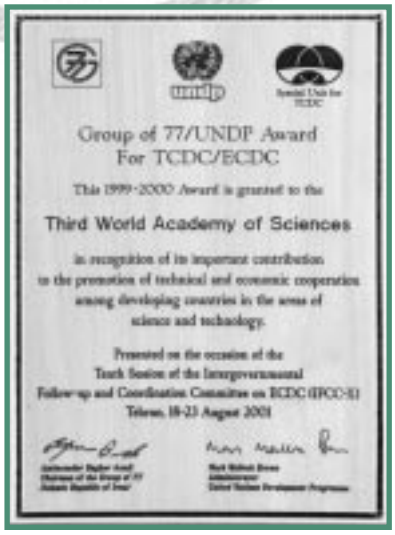
SCIENCE TAKES CENTRE STAGE AT G77

SOUTH SUMMIT IN HAVANA AND G77/UNDP AWARD TO TWAS MARK NEW ERA FOR UN'S LARGEST NETWORK OF DEVELOPING NATIONS.

As the process of globalization reaches into the farthest corners of our planet, eliciting strong voices of support matched by equally strong voices of dissent, it has become difficult to find calm expressions of reason in this heated debate.

Equally important, as representatives of such international bodies as the Group of 8 (the world's richest nations), the World Trade Organization (WTO), the World Bank, and the International Monetary Fund (IMF) meet under conditions that have come to resemble a state of siege, it is increasingly clear that an open and constructive dialogue must be fostered between the North and South if globalization is to become a truly global force willingly supported by the world's peoples.

Amid all of this clamor, what has been missing from much of the ongoing debate concerning globalization is the voice of the developing world, vast areas of the globe that have often failed to share the benefits created by the relentless internationalization of commerce, trade and electronic information. Those who protest against globalization, most of whom hail from the North, claim to speak for the have-nots in the South. However, for the debate to be truly meaningful, the South must speak for itself, not through surrogates, no matter how well-meaning and sincere the surrogates may be. In short, the debate over globalization must be truly global.


Group of 77/UNDP Award
For TCDC/ECDC

This 1999-2000 Award is granted to the

Third World Academy of Sciences

in recognition of its important contribution to the promotion of technical and economic cooperation among developing countries in the areas of science and technology.

Presented on the occasion of the Tenth Session of the Intergovernmental Follow-up and Coordination Committee on ECDC (IFCC-X) Tehran, 19-23 August 2001

The Group of 77 may not be well-known beyond the United Nations system but it has been a powerful global force since its inception in the mid-1960s. In fact, the G-77 has become the most important voice for developing countries not only at UN headquarters in New York but at UN centres in Geneva (United Nations Conference on Trade and Development/WTO), Nairobi (United Nations Environment Programme), Paris (United Nations Educational, Scientific and Cultural Organization), Rome (United Nations Food and Agriculture Organization), Vienna (United Nations Industrial Development Organization), and Washington, D.C. (IMF and the World Bank).

The organization's success can be measured in part by the growth of its membership, which now stands at 133 countries. G-77 member states from Africa, Asia and Latin America and the Caribbean are home to 4 billion people or 70 percent of the Earth's population. The G-77's influence can also be measured by the group's active involvement in virtually all essential discussions that take place within the United Nations.

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Whether the issue is poverty eradication, globalization or financing for development, the G-77 is invited to lend its opinion to the decision-making process and to leave its mark on the final declarations and reports.

The roots of the G-77 lie in discussions related to global trade, commodity pricing, capital investment and external debt. Indeed the G-77 first took shape in the post World War II era in response to debates surrounding the new international economic order following the end of colonialism and the quest for independence throughout much of the developing world.

Since then, the organization's efforts have focused on programmes designed to make the often impenetrable system of global commodity pricing and world trade more equitable. Put another way, the G-77 seeks to reverse the chronic tilt in world trade policies and programmes towards rich countries in the North at the expense of their poorer counterparts in the South.

The G-77 focus on global trade and other development issues continued until the first-ever G-77 South Summit held in Havana in April 2000. More than 2000 officials from developing countries, including many heads of states, attended the event.

The summit's declaration and programme of action, which were unanimously approved by the participants, not only cultivated familiar territory in finance and economics, but also broke new ground by emphasizing the need for developing countries to devise effective strategies for the promotion of science and technology. As a result, issues related to science and technology, which had largely been ignored by the G-77 until then, have emerged as primary elements in the group's overall efforts to advance the cause of sustainable economic development.

The importance of science and technology was stressed in the Havana Programme of Action. Here are some examples of what was stated:

"Today, more than ever, rapidly advancing science and technology development, particularly in such areas as microelectronics, biotechnology, and information technology, play a critical role in economic and social development."

"We recognize that information technology constitutes one of the pillars of the technological revolution and represents one of the most powerful development tools of our

time. We should take full advantage of this unique opportunity...to ensure that its benefits reach our people."

"Faced with the threat of technological marginalization of the South, member states of the G-77 have decided to make science and technology a priority item on the national agenda as well as in the area of South-South cooperation."

On the heels of the South Summit, the G-77 has launched a special trust fund to promote the advancement of knowledge and technology in the developing world. The fund's goal is to nurture the development and use of science and technology in fields of vital importance to the economic and social well-being of developing countries. Seed money will be solicited from governments, private corporations, foundations and individual benefactors. Among the activities that the G-77 hopes to sponsor are research grants, fellowships and awards for scientists, and capacity-building and networking among institutions, especially institutions of excellence in developing countries.

The G-77's increased focus on science and technology as vital tools for sustainable economic development has raised its interest in working with TWAS – and for good reason. TWAS is one of the world's most respected organizations for the promotion of science and technology in the South. The Academy, moreover, enjoys strong ties with the developing world's most prominent scientists. When combined with G-77's new agenda for science and technology, we think that an enduring working partnership between TWAS and the G-77 will have a dramatic impact on the advancement of science and technology throughout the South.

We have learned from the harsh experience of the Vienna Conference on Science and Technology in 1979 that well-intentioned but vague strategies for the transfer of technology from the North to the South, as well as unrealistic pronouncements for the creation of a multibillion science and technology fund for the South, do not work. Some 30 years after this conference, which ended with such high expectations, little useful technology has been transferred and the expected multibillion science and technology fund, long defunct, never exceeded a few hundred thousand dollars.

What is clear is this: Future progress in the economic and social well-being of the South will depend largely on the initiatives and commitments of developing countries themselves. At the same time, the primary tools that developing countries must devise to ensure the success of these initiatives will be based primarily on the knowledge and skills they acquire. This realization led the G-77 to award TWAS the Group 77/ UNDP Award for 2000. It has also prompted our desire to work closely with the Academy on a number of science and technology initiatives of mutual concern.

As the Havana Programme of Action notes: "Globalization is a process which can be uneven and unpredictable, but if it is properly harnessed and managed, the foundations for enduring and equitable growth at the international and national levels can be laid."

That perception, which stands in sharp contrast to the extreme positions that have been taken by globalization's advocates and critics, is now shaping the G-77 agenda.

Our relationship with TWAS will be critical to our success as we seek to harness the forces of globalization in ways that will prove beneficial not only to those who now enjoy a bounty of material comforts but to those who do not. Together the G-77 and TWAS can play a powerful role in setting an agenda for globalization that will garner support from both the South and the North – precisely because it is an agenda designed to work for all people. ■

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ASIA'S DIVERSE DRYLANDS

MONGOLIA'S NATIONAL ACADEMY OF SCIENCES HOSTED GEF/TWNSO'S FIRST REGIONAL WORKSHOP ON BIODIVERSITY IN DRYLAND REGIONS. TWO DOZEN SCIENTISTS FROM 11 ASIAN COUNTRIES WERE IN ATTENDANCE.

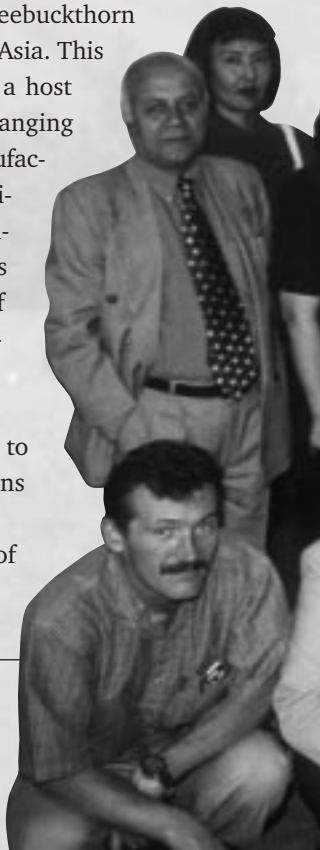
Mongolia's steppes – undulating tawny grasslands punctuated by gnarled gray-faced outcroppings – served as an apt backdrop for the Third World Network of Scientific Organizations' (TWNSO) first regional workshop on the conservation and wise use of biodiversity in dryland regions.

The workshop, which took place from 20-23 August, is part of a two-year initiative sponsored by the United Nations Environment Programme (UNEP) Global Environment Facility (GEF). The project is designed to highlight experiences among scientific institutions in the South that have successfully responded to the biodiversity challenges found in arid and semi-arid regions. (For a brief description of the planned activities and overall objectives, see sidebar, "GEF Project").

The Asian workshop was held in Mongolia's capital city of Ulaanbataar, a rapidly changing city of 500,000 people located in the centre of one of the world's oldest yet most remote countries. Twenty-five representatives from 11 Asian nations, including China, India, Nepal, Japan, Russia, and Tajikistan, participated in the event.

Among the experiences examined were:

- An initiative launched by the International Centre for Integrated Mountain Development (ICIMOD) to introduce seebuckthorn (*Hippophae L.*) on mountain slopes across Asia. This hardy, deeply rooted plant, which enjoys a host of potential commercial applications ranging from the production of wine to the manufacture of facial cosmetics, can also help stabilize fragile mountain soils that are vulnerable to erosion, especially hillside soils found in harsh arid climates. Acreage of seebuckthorn in China has increased dramatically over the past several years, indicating growing acceptance of this crop. ICIMOD has now introduced seebuckthorn to farmers and herdsmen in other nations throughout central Asia.
- A personal account of a 50-year labour of love in taxonomical research and classifi-



cation conducted by Mongolian scientist, U. Ligaa, chairperson, Foreign Relations Committee, Chinges Khaan Academy, which has resulted in a 400-page illustrated monograph offering a detailed portrait of his nation's treasure trove of medicinal plants – some 450 species in all. The monograph has helped stimulate a fruitful dialogue between traditional medicine healers and university-trained researchers not just in Ligaa's home country but throughout central Asia.

• An examination of the cultural and environmental conflicts plaguing Keoladeo National Park in northern India's semi-arid terrain. The park, located in the state of Rajasthan, is a "human-made" nature reserve originally designed by an English nobleman at the turn of the 20th century as a private duck shoot. Today, as M. Chauhan, researcher, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, noted, Keoladeo National Park is one of India's most frequently visited parks, a lush green oasis in a parched brown environment. A wire fence now walls off the park from its neighbours who once had access to the timber resources, fish and wild game found within the reserve. That divide, which has sparked tensions between park officials and local residents, raises serious questions about how to balance the competing environmental, recreational and economic pressures now being exerted on India's national parks and nature reserves. At the same time, policies that allow for the drilling of water wells but ban the removal of forage have dramatically altered the park's ecology and adversely impacted its biodiversity. Such

The project highlights experiences in the South that have successfully responded to biodiversity challenges in arid and semi-arid regions.

[CONTINUED PAGE 10]

management issues are likely become even more contentious in the future as the nation's population and wealth continue to grow.

• A bilateral research effort, led by P.D. Gunin, chief and director, A.N. Severstov Institute of Ecology and Evolution and the Russian-Mongolian Laboratory Expedition, Russian Academy of Sciences, to map the geophysical features of the vast Trans-Altayan and Karakorum desert that straddles the border between Mongolia and Russia. This effort, which began before the collapse of the Soviet Union, has survived the tumultuous political events of the past decade. Today, its living legacy lies in the vast storehouse of environmental data that has been accumulated over time and the strong professional ties that have developed among Mongolian and Russian scientists. These scientists share a broad knowledge and deep respect for this glorious but fragile ecosystem that is now threatened by assaults ranging from the introduction of non-native species (for example, cannabis and hemp) to the spread of such desert mosses as *Tortula desertorum*.

Despite great differences in local and regional conditions ... Asia's drylands share a common set of problems.

What each of these and other workshop presentations revealed is that despite great differences in local and regional conditions (the continent's arid environments range from glacier-capped arid peaks in Nepal's Himalayas to searing white sands in Mongolia's Gobi desert), Asia's drylands share a common set of problems that have been exacerbated by increased population pressures, more intensive land use patterns, and rising global temperatures.

As B. Gopal, professor, School of Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, pointed out, "arid lands cover 33 percent of the total land mass in Asia, a significant portion of the landscape but far less territory than in Africa and the Middle East," where arid lands account for some 60 percent of the terrain.

As Gopal also pointed out, Asia's drylands are important not only because they are home to more than 225 million people in the region but because they are rich in both plant and animal biodiversity that has evolved over eons of time in an environment where a premium is placed on the ability of organisms to adapt to harsh unpredictable conditions.

While Asia's drylands are by definition places that experience extremely low rainfall (200 millimeters or

GEF PROJECT. *"Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones" is a two-year project funded by the United Nations Environment Programme (UNDP) Global Environment Facility (GEF). The project has three principal goals: to examine the best practices in the conservation and sustainable use of biodiversity in dryland regions; to promote South-South cooperation; and to assist efforts on the part of local populations to advance these goals. The first "all-participants" meeting took place in Trieste, Italy, on 4-6 April 2001 (see* TWAS Newsletter*, April-June 2001, pp. 15-21). The Asian regional workshop discussed in this edition of the* TWAS Newsletter *will be followed by two additional workshops to be held in the Sultanate of Oman (late February 2002) and Chile (mid March 2002). An international workshop will take place in the autumn of 2002 in Egypt. Among the anticipated outcomes of the project are the publication of full-length monograph describing innovative experiences in the conservation and sustainable of dryland biodiversity, the creation of a website, and the launching of an institutional network dedicated to exploring issues related to dryland biodiversity on a continuous basis.*

less per year), these regions are not entirely devoid of precipitation. In fact, the continent's arid zones often encounter long, interminable stretches of sparse rainfall sporadically interrupted by spasms of heavy rain. At times, these cycles of dryness and deluge unfold over periods of 20 to 25 years – an extreme range of climatic conditions that have prompted a diverse and unique biodiversity characterized by organisms that can survive lengthy periods of too-little rainfall interspersed by short spurts of too-much rainfall.

In addition, extensive bodies of water are found throughout Asia's dryland regions. The historic Tigris and Euphrates rivers run through the arid lands of southwest Asia, and the Indus River winds its way through Tibet, India, and Pakistan. Asia's dryland regions are also the site of large lakes and extensive coastal seas, including the Caspian Sea between northern Iran and southern Russia, Lake Balkhash in Kazakhstan, and Lake Baykal in Mongolia, which serve as oases in otherwise parched environments. Wetlands can also be found in dryland regions, serving as important nature reserves for waterfowl, especially migratory species.

Throughout history, these bodies of water have provided thirst-quenching lifelines for the region's rich diversity of organisms. Wise management practices must now be pursued to ensure that these "drinking holes" maintain their irreplaceable ecological functions and services in the future. The Soviet Union's misguided efforts to use the river waters leading to the Aral Sea for the irrigation of cotton – an effort begun in the 1960s – stand as a grim reminder of the perils that await unsustainable management practices in dryland zones. The sea's volume has shrunk by 60 percent over the past four decades exposing a desert shoreline that has been the source of more than 200,000 tons of windblown salts and chemicals cast as far as 500 kilometres away. The world's fourth largest lake has evaporated into the world's eighth largest lake.

MONGOLIA'S BIODIVERSITY CHALLENGES

Mongolia's arid lands – its steppes and semi-desert and desert zones – are "becoming drier and ecologically poorer," as this far-away nation, with a land mass three times the size of France but a population of just 2.5 million people, faces a host of environmental problems usually associated with less harsh and more populated places. A. Bolat, Deputy-Chairperson, Ministry for Nature and Environment, offered this compelling assessment at TWNSO's regional workshop on the conservation and wise use of biodiversity resources held in Ulaanbaatar, Mongolia, 20-23 August.

"Nearly half of our nation's arid and semi-arid land, which covers some 100 million hectares or about 50 percent of the nation's total land mass, is at risk of being transformed into permanent desert," he notes. "As a result, the rich biodiversity found on these fragile lands is being increasingly undermined." The growing number of endangered plant species, now totalling 100, is one indicator of the increased risk faced by these ecosystems; so too is the declining number of large animals, including Mongolia's one-humped Bacterian camel, the snow leopard and the Gobi bear.

"There are many forces driving these trends," notes N. Oyundar, Director, International Cooperation Department, Mongolia Ministry for Nature and Environment. For example, experts estimated that Mongolia's pasture land cannot accommodate more than 50 to 60 million livestock, historically comprised primarily of cattle, goats and sheep. Yet, today, the total number of livestock exceeds 72 million, in large measure due to post-socialist policy reforms promoting the private leasing of pasture land. Meanwhile, a dramatic rise in mining operations, which have increased 10 fold over the past decade, has left a trail of scarred landscapes, barren soils and polluted waterways in its

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wake. Windblown soils from these moon-like landscapes have been deposited as far away as South Korea. At the same time, strip cultivation and the increased use of fertilizers, which have been embraced to increase the output of cash crops, are sapping soil fertility and accelerating soil erosion. Finally, the impact of global warming has made Mongolia's continental climate even drier and more unpredictable. Throughout the 1960s, for example, climatologists reported 20 stormy days a year on average in Mongolia's grasslands; in 2000 alone, they recorded 80 stormy days.

"The combined effect of all these factors," Oyundar concludes, "presents enormous challenges both for Mongolia's arid ecosystems and the governmental agencies responsible for their environmental protection."

Historically, Mongolia's ecosystems were protected by the nation's semi-nomadic way of life. Such patterns of behaviour, which left a gentle imprint on the land, placed limited stress on the nation's ecological resources. "But that way of life, which dates back more than 2000 years, is now rapidly disappearing," says Oyundar.

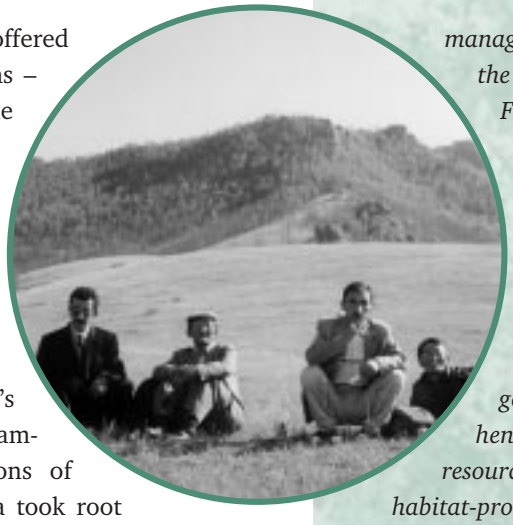
Since the mid 1990s, Mongolia's government has passed a variety of environmental laws designed to meet the challenges posed by a more settled society built increasingly on market-based economic principles. For example, Mongolia's government has enacted laws for the protection of endangered wildlife. It has introduced payment fees for access to hunting and trapping reserves. And, most importantly, it has authorized legislation calling for 30 percent of the nation's land mass to be designated as protected areas over the next few decades (currently just over 10 percent of Mongolia's land mass is protected).

Mongolia's government, especially the Ministry for Nature and Environment, is also working with such international organizations as the World Wildlife Fund and UNDP's Global Environmental Facility, to list and protect endangered species. As a result of these efforts, some 30 species of mammals and birds, 6 species of fish, and 19 species of insects have been registered as rare or very rare species, allowing for the implementation of additional policy measures for their long-term protection. Breeding programmes – for beaver in Lake Tes, antelope and camel in the Gobi desert, and white gazelle in the steppes – are designed to ensure the survival of endangered species through a comprehensive

Finally, the vast grasslands found in many dryland regions, including those in Mongolia and Russia, represent complicated ecological systems harbouring extensive resources. Such grasslands currently face unprecedented risks due to habitat degradation, excessive water extraction, unrestricted mining and overgrazing. All of these trends have been accelerated by the dramatic social and economic changes that have taken place over the past decade, including rapid population growth, urbanization and the move toward market-based economies.

One example illustrates the rippling effect that new policies can have on dryland ecosystems. The introduction of long-term land leases in Mongolia's steppes, following the fall of communism in the early 1990s, has encouraged local herdsmen to increase the number of grazing animals per hectare as a way of enhancing their family incomes. The result has been an intensification of land use that has placed large areas of the steppes at risk. These fragile grassland environments simply cannot withstand the onslaught of additional cattle, goats and sheep. Scientists now fear the spread of desertification throughout the region unless a more sustainable grazing policy can be devised.

In face of the rapid changes now sweeping across much of central Asia, what can be done to protect and wisely use the biodiversity that exists within the region's arid and semi-arid zones?



Workshop participants offered a series of recommendations – some that would focus on the resources themselves; others that would apply more generally to environmental policies and management practices.

First, participants noted that Asia's arid regions were home to some of the world's oldest civilizations. For example, the ancient civilizations of Sumeria, Assyria and Persia took root and flourished along the Tigres and Euphrates river valleys. Thousands of years of survival within these regions have generated a great deal of knowledge about the fragile ecology. Such knowledge, participants agreed, should be used in conjunction with contemporary scientific and technical know-how when devising future strategies for sustainable development.

Second, as first noted by Gopal, participants concurred that continuing to define water as a public commodity and service offered the most effective strategy for protecting this vital resource in ways that would address the needs of the entire population. Such long-term conservation and wise management of water resources would have an important impact on both the region's biodiversity and the social and economic well-being of people who live in these arid zones.

Third, there was a sense among participants, most forcefully expressed by K.G. Sexana, School on Environmental Sciences, Jawaharlal Nehru University, New Delhi, India, on the need for nations and regions to carefully consider the long-term implications of agricultural commodity production – a trend that has become increasingly prevalent in recent years as nations have swiftly embraced market-based economies. A greater reliance on traditional staple crops and more restrictive grazing polices would help preserve the existing ecological system and, as a result, help protect the biodiversity of dryland areas over time.

At the national and international level, participants acknowledged that it was important for local and regional entities to interact with both national and

management programme often pursued with the help of international partners.

Finally, the government of Mongolia has placed a great deal of importance on the implementation of the Convention on Biological Diversity. A national plan has been published and elements of the plan have been transformed into action strategies with the help of regional and local officials. The overall goals include: (1) providing a comprehensive assessment of existing biological resources, and (2) launching a wide range of habitat-protection programmes designed to reduce the ecological and economic stresses that have been exerted on these resources.

While progress has been made in efforts to build a national framework based on the principles of the Convention on Biological Diversity, Bolat notes that a "lack of resources, limited public participation and the weak capacity of the convention's national committee have slowed our progress." Nevertheless, he says that Mongolia has come a long way over the past decade in devising effective strategies for the protection of its biodiversity, including its biodiversity in dryland regions.

"Government spending has increased, a legal framework for environmental protection has been put in place, the skill of our staff is on the rise, and citizen appreciation for our programmes is growing." Yet, he adds, "the risks faced by plant and animal species throughout Mongolia, especially in the nation's extensive arid and semi-arid lands, has never been greater." As a result, he notes, "we will have to expand our initiatives even more if we are to avoid facing the unenviable and exhausting position of running harder and harder only to lose more and more ground." ■

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international institutions whose mandates focus on the protection and sustainable use of biodiversity resources.

Donald A. Brown, a member of the project's advisory board, noted that both the Convention on Biological Resources and the Convention on Biodiversity offer valuable frameworks for advancing the goals of biodiversity protection in arid and semi-arid regions. "Knowing how a local or regional initiative fits into the national programme," he asserted, "may open new avenues for technical assistance and would likely provide valuable information about possible funding opportunities."

Nevertheless, Brown acknowledged that many of the "nicely bound national plans" that have been prepared in response to these conventions "have remained on library shelves collecting dust and rarely have been transformed into action-oriented programmes." Consequently, he noted, representatives from local and regional organizations "have often ignored these publications and at times expressed cynicism towards oversold but underutilized national and international initiatives designed to protect biodiversity resources on a global scale."

We all have a lot to learn from one another, but ultimately the experiences of others must be tailored to fit local and regional circumstances.

W. Bradnee Chambers, from the United Nations University (UNU) in Tokyo, expanded on Brown's analysis to discuss how international environmental treaties, which now exceed 200 in number, have increasingly become "diplomatic avenues for the intersection of science and politics." He cited treaties focusing on issues related to ozone depletion, rainforest loss and climate change as prime examples of how governments have been trying to work together to meet global environmental challenges in an effective and coordinated fashion.

Chambers admitted that these treaties often "fail to live up to their expectations" but he nevertheless stressed that "the accords, despite their shortcomings, have proved to be key elements in advancing international cooperation, generally, and global environmental policies, specifically." He contended that these accords could be strengthened through several reform measures, including efforts to link conventions through broad policy issues of common concern (such as technology transfer, institutional capacity building and public awareness). Such links, Chambers observed, could be forged by the sharing of data and experiences either informally or through the building of inter-treaty frameworks.

Global environmental issues, Chambers went on to say, are rarely bound by the provisions that define international conventions. Dryland areas, for example, are not only threatened by the spread of desertification (covered under the desertification convention) but

also have an impact on climate change, due to increased levels of carbon dioxide emitted into the atmosphere as a result of deforestation, grassland degradation and soil erosion (carbon dioxide emissions are covered under the global warming treaty).

Such concerns prompted the UNU to organize the first international conference on environmental treaty linkages in 1999. That meeting has been followed by several others in which participants examined a broad range of issues related to science, institutional reform and information exchange. "The ultimate goal," explains Chambers, "is to develop mechanisms and models that allow for greater interaction among treaty proponents at local, regional, national and international levels. This interaction will help instill greater confidence in the treaties, which in the long run should help to make them more effective."

Whether examining the impact of global environmental treaties or exploring local experiences in the conservation and wise use of biodiversity resources in arid and semi-arid Asian regions, conference participants agreed that success in meeting the challenges posed by these issues would ultimately depend on our ability to build local and regional capacities both in science and management. As S.R. Chalise, consultant, Mountain Resources Division, ICIMOD, noted in his presentation, "the sharing of experiences is vitally important, but progress made in one place will not necessarily be successfully replicated in another place." He agreed that "we all have a lot to learn from one another, but ultimately the experiences of others must be tailored to fit local and regional circumstances. And that requires local and regional expertise and know-how."

Creating channels for building that expertise and know-how is one of the main objectives of the TWNSO project "Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones." The next stop in this ongoing journey is Muscat, Sultanate of Oman, where project participants will gather at Sultan Qaboos University early next year for a joint regional workshop devoted to dryland biodiversity issues in Africa and the Middle East. ■

For additional information about this TWNSO biodiversity project, please contact ⋯ ***Sheila Khawaja***
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World renowned botanist, Sir Ghillean Prance has enjoyed a 40-year career as a researcher, administrator and educator of the first rank. Born in Suffolk, England, in 1937, he was educated at Malvern College, Worcestershire, UK, where he received a bachelor's degree in botany in 1960, and Keble College, Oxford, UK, where he earned a doctorate degree in 1963.

Sir Ghillean began his career with the New York Botanical Garden in 1963 as a research assistant. Remaining with the institution for more than a quarter century, he held a series of increasingly important positions, including B.A. Krukoff Curator of Amazonian Botany, Director and Vice President of Research, and Senior Vice President for Science. He also established the Garden's Institute of Economic Botany and was appointed its first Director in 1981, a post he held for eight years.

SIR GHILLEAN PRANCE

In 1988, Sir Ghillean became the Director of the Royal Botanical Gardens, Kew. He continued in that capacity until 1999. Today, he is the Scientific Director of the Eden Project, UK, which is dedicated to communicating the importance of plants to the public, especially to children.

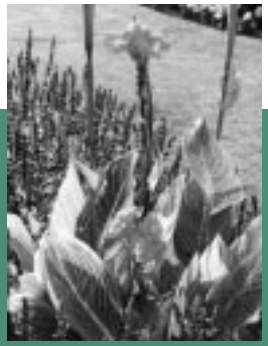
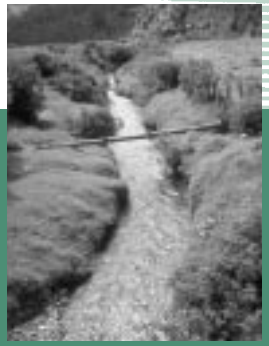
Sir Ghillean was the founding Director of the graduate studies programme at the National Amazon Research Institute (Instituto Nacional de Pesquisas da Amazônia), Manaus, Brazil. He has taught at City University in New York and Yale University (USA) and the University of Reading, UK, and has served as president of the Linnean Society of London, the Association of Tropical Biology and the American Association of Plant Taxonomists. He holds honorary degrees from 12 universities in Europe, South America, and the United States, and has received numerous awards for his research and public service. He was knighted in 1995.

Sir Ghillean, who is a member of the advisory board of the TWNSO project, "Promoting Best Practices for the Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones," visited Trieste to attend the project's first workshop, held in April 2001. During his stay, the editor of the TWAS had an opportunity to speak with him about his long and distinguished career. Excerpts follow.

Tell us about your career, how it began and how it has evolved over time.

I became fascinated with plants when I was a child. Two of my aunts, who devoted much of their leisure time to studying botany, encouraged me to share their interests. I was also fortunate to attend a school where the schoolmaster was a biology master. He inspired me as well. I studied biology at Malvern College, Worcestershire, UK, receiving my degree in 1960. I enjoyed my classroom studies. However, field work, with its sense of adventure and discovery, has always proved the greatest attraction for me. During my undergraduate

years, I participated in a university expedition to Turkey that spurred my interest in Middle East flora. Then, during a summer stay at Oxford, I worked on a project focusing on African flora. The latter experience prompted an offer to enroll in a Ph.D. programme in tropical plants at Keble College, Oxford. The opportunity to become involved in a new geographical area of study was too great to pass up. So I decided to accept the position instead of returning to Turkey. At first, I worked on the taxonomy of tropical flora in Africa but I soon found my interests drifting towards the tropical flora of South America. After earning my doctorate in 1963, I was determined to visit South America to continue my studies of the plant family *chrysobalanaceae*, the focal point of my dissertation. Then my good fortune took an even more fortunate turn. Before I even had a chance to devise a way of getting back to South America, the head of the New York Botanical Garden invited me to join an expedition in Suriname, a tiny country in northern South America, and then to return to New York to analyse the findings. In my mid twenties, with a newly minted Ph.D., I travelled to the tropics to study plants that I wanted to study – and I was being paid to do it! I had no way of knowing that I would spend the next 25 years with the New York Botanical Garden, climbing the institutional ladder from a one-year post doc to senior vice president. The study of tropical plants in South America was never far from my core responsibilities. During my third year at the Botanical Garden, I was offered a position to do research on Amazonian plants and, as a result, I became involved in a series of expeditions that allowed me to broaden my scientific interests. My research usually took place among local people. That, in turn, gave me an opportunity to study ethnobotany – the way people use plants. One day in early summer 1972 the director of the National Amazon Research Institute told me that two students had decided not to return to their homes in South America after completing their studies in New York. I responded that such trends could only be reversed if students were trained locally. Only then would students be less willing to migrate to the United States or Europe. He agreed and quickly added that the head of the institute's research council was coming to New York the following day and it would be good to have a proposal for such a programme ready for his review. I rushed home and with my wife spent the night designing a graduate programme on tropical botany. I delivered the pro-

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posal the next morning and returned home to sleep. In the late afternoon, the director called to say that the proposal had been approved and that I been appointed project director. But I had a job in New York, I said. The director told me he would ask the president to grant me a leave of absence, which he did. That's how I became the founding director of post graduate studies at the National Amazon Research Institute, setting up graduate programmes. Students would soon join Robert Goodland, then my colleague at the New York Botanical Garden (he would later work for the World Bank) and me on a trip to the Transamazon Highway, just after the completion of the first section of the roadway, to see first-hand the ecological destruction caused by its construction. That experience deeply affected both Goodland's and my career. After reading Goodland's book, *The Amazon Forest: Green Hell to Red Desert*, I began to appreciate that my research had to do with more than the environment. I broadened my approach from the study of the Amazon forest to the study of the entire Amazon ecosystem and from tightly focused basic scientific investigations to broadly based explorations in economic botany and ethnobotany intended to promote sustainable forest use by addressing integrated biological, economic and social challenges. Over time, I was appointed to a series of posts at the New York Botanical Garden, including director of research, vice president, senior vice president and ultimately the first director of economic botany. After a rewarding two decades plus of work, I left there in 1988 to become director of the Royal Botanical Gardens, Kew, where I served for 11 years. My tenure at Kew Gardens was marked by an expanded institutional agenda into areas that I think are of primary importance for the world's ecosystems – resource conservation and sustainable development. I viewed my work at Kew Gardens as both a natural extension of my previous efforts and the culmination of a quarter century of ideas on how to meld issues related to botany, society and economy in ways that people could understand, appreciate and apply.

The roots of your career lie in scientific research but your work gradually evolved into areas that reside at the complex intersection of science, economics, social behaviour and ethics. What accounts for this evolution?

When I first began my career I was interested in biology and nothing more. Then, in the early 1970s, I became increasingly aware of the adverse impacts associated with environmental degradation and decided to focus more attention on trying to understand the full range of forces responsible for such problems. It soon became clear to me that understanding such forces required an examination of issues well beyond science. In 1976, Tom Alais, my colleague at the New York Botanical Garden, and I coordinated a symposium, "Extinction is Forever." We subsequently edited a volume of the proceedings that carried the same title. These activities took place at an early stage in the environmental movement. My concerns for the environment, articulated in the symposium and the work we did on the monograph, soon were heightened in response to the deteriorating environmental situation unfolding on a global scale. I became particularly worried about the grim plight of indigenous people who live close to the land and depend directly on healthy ecosystems for their economic and social well-being. Setting environmental issues straight, I discovered, would entail more than scientific research; indeed it would involve economic and

social considerations as well as an understanding of ethical and human rights issues. Questions related to resource management and biodiversity would be paramount to effectively tackling the issues, but so would questions related to intellectual property rights and commercial applications. One of the great triumphs of the environmental movement over the past quarter century has been to incorporate such broad ranging issues into the discussions and to emphasize that little progress will be made on the environmental front unless we extend the lens of our investigations and analyses to encompass economic, social, legal and ethical issues. We certainly need to understand how ecosystems function, but we need to understand much more than this as well.

How would you describe both the state of scientific research and the state of environmental policies in the developing world at the time you first became interested in a broader definition of science? How would describe the state of scientific research and environmental policies now?

When I first began my career, most countries in Latin America were under military dictatorship. There was little, if any, interest in science beyond its potential military applications – and virtually no interest in environmental protection policies at all. It wasn't until the 1980s, when Brazil and other South American countries became democratic, that grassroots organizations began to surface and have their voices heard. Many of those organizations placed the environment and sustainable development at the top of their agendas. In addition, the government of Brazil, perhaps more than most other governments in South America, began to invest in science and to enact environmental legislation at levels unprecedented in its history. One could argue that there's a relationship between democracy, grassroots activism, science and the environment. I must say that some of the enthusiasm for the environment that's now being displayed by countries in Latin America puts countries in the North to shame. There are untold nongovernmental organizations (NGOs) involved in the environmental issues in Brazil and many influential people as well. That's also true of other Latin American countries that I've visited. It's heartening not only to see such levels of institutional commitment to environmental issues but to witness the involvement of the public. Throughout the region, scientists are not the only ones involved or invited to discuss important issues related to natural resources and sustainable development.

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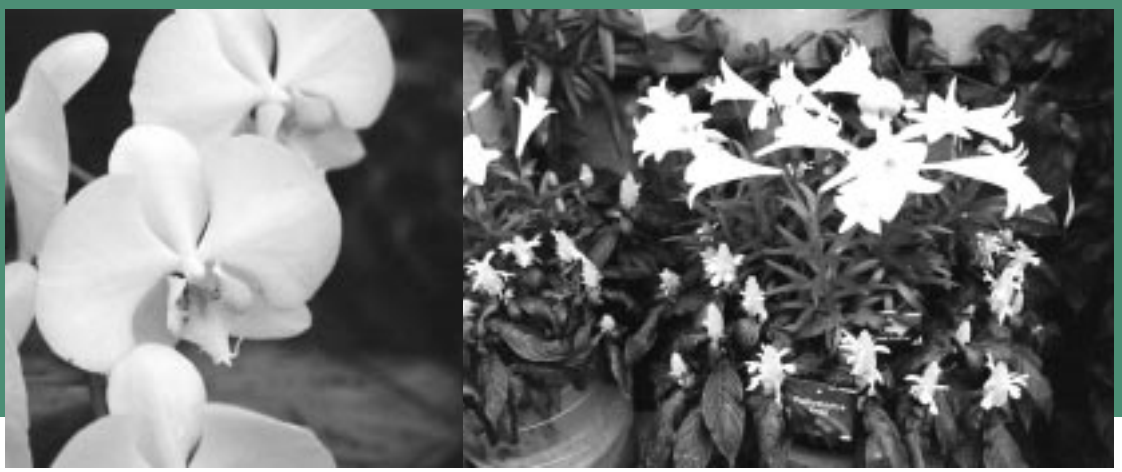

You've divided your career between a number of continents – Latin America, North America and Europe – and you've spent some time in Africa as well. Please tell us how this has influenced your work.

After my first year, my job in New York was divided between spending some time there and some time in the Amazon region. Basically my trips to Brazil were expeditions to explore and discover plants in the region. Upon my return to New York, the facilities and library at the Botanical Garden allowed me to do the identification and research on the plants. The follow-up research was not done in isolation, however, but included contact with the indigenous people. One of the great joys of my career has been to witness the increasing involvement of indigenous people in the research and identification of native plants. Such involvement has not only enriched my experience but also enriched my scientific research.

Please describe your work as director of Kew Gardens in London.

During my 11-year tenure at Kew Gardens I did less research than I had in my previous positions. I was more like a chief executive officer of a large institution that employed nearly 600 people working all over the world. Nevertheless, I found time to pursue personal research in the Amazon River region and pushed for an expanded Kew Gardens research agenda on arid lands, which allowed us to turn a small project in northeast Brazil into a major one. Kew Gardens financed the project through a million pound grant. Once off the ground, the project involved many Brazilians and Brazilian institutions in the area. The project slogan, in fact, was "Local Plants for Local People." Our early success attracted the attention of the Brazilian National Research Council, which has since contributed generously to our efforts. After many tries, we also secured funds from the UK Department for International Development (DFID). Our aim has been to assist the people of northeast Brazil in devising strategies for the sustainable development of their botanical resources. My second major contribution at Kew Gardens was the creation of a seed bank. When the government of the United Kingdom announced it would sponsor 10 major projects to celebrate the new millennium, I said to my staff that we had to get one of them. I asked for ideas and of the 10 proposals submitted, including proposals to expand the library and create a memorial garden, one clearly stood head and shoulders above the others: development of a seed bank. Based on the government's favourable response, we set out to

create the Millennium Seed Bank. The goal was to record and 'bank' all British flora by 2000, which we did. Prince Charles opened our new building in November 2000. Then we decided to expand our efforts and collect another 10 percent of the world's flora by 2010 in arid lands and to build a new facility for this purpose. We received half of the money from funds generated by the UK lottery and raised the remaining part from foundations. We've also reached agreements with many countries, including many developing countries, that prohibit us from passing seeds to third parties without the approval of the country that has donated them. The main purpose of the seed bank is to save seeds in arid lands that historically have been far more neglected than seeds in more humid areas.

What important lessons have you learned during your career, especially when it comes to South/North relations?
One of the big lessons is that scientific research alone cannot adequately address the issues but that it's essential to acknowledge and draw on the wisdom of local people. Of course, we need good science and better scientific tools are being developed all the time. But how we use these tools – and who uses these tools – are also very important. As a result, a critical question is how to share the most up-to-date scientific information with local people and how to encourage local people to share their knowledge with scientists. If science fails to listen to the wisdom of local people, it will miss many great opportunities to discover how to use resources sustainably based on "field experience" that dates back many generations. Another lesson that I've drawn from my years of experience is that it's important to bring people from different disciplines and perspectives together to share their knowledge and ideas. We often isolate botanists, anthropologists, ecologists, chemists and discourage them from working together, even though the environmental problems that we face today cannot be solved by a single discipline no matter how expert its practitioners. That's why I've been encouraged to see that those involved in the TWNSO project, "Promoting Best Practices for the Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones," are not all botanists like myself but in fact come from many disciplines. Interplay among disciplines is the best path for devising innovative solutions to an entire host of environmental issues, including the conservation and wise use of biodiversity in drylands.

You're now involved in a new project, the Eden Project. Could you tell us more about it?
I began working on the Eden Project while still at Kew Gardens. This project, located in Cornwall, in eastern England, is devoted to botanical research and education. In many ways, it's an extension of the environmental projects that were initially funded by the British government to celebrate the new millennium. The goal is to fully explore the importance of plants and encourage their sustainable use both through the application of science and greater public awareness and understanding. Half of the project is funded by the UK national lottery and half by money Kew Gardens has raised. The first thing we did is to rehabilitate the moonscape left behind by decades of mining. That meant our initial efforts

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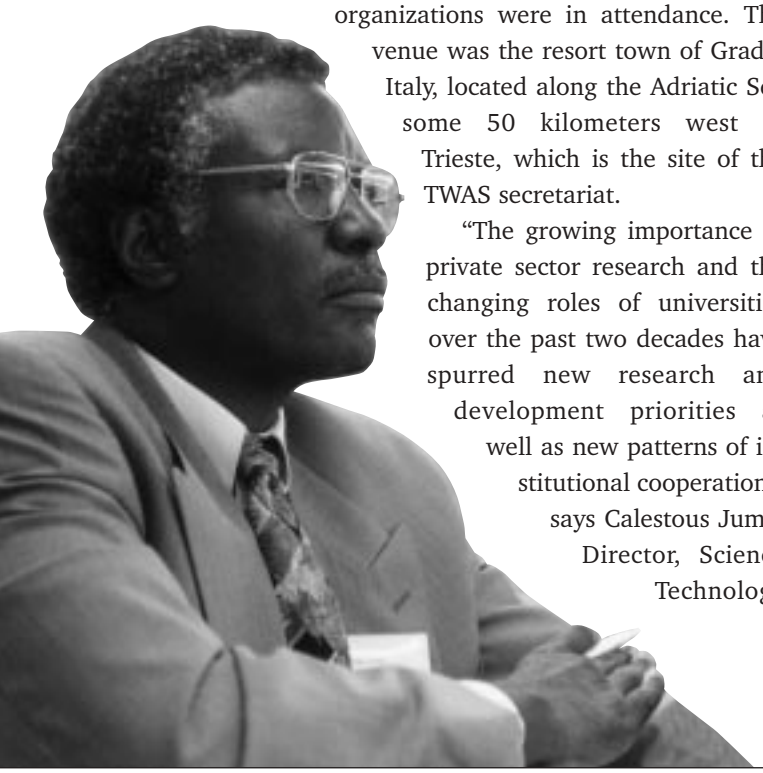
focused on restoration ecology. Once we restored the habitat, we began to construct the complex. The project consists of a series of domes, covering some five acres, that enclose simulated rainforest and Mediterranean ecosystems. In fact, we've built the world's largest indoor rainforest conservatory. Much of the area beyond the domes contains samples of cereals and other plants that can be grown outside in England. In addition to being a research centre, the Eden Project is an educational centre replete with exhibits and demonstrations designed for visitors of all ages. We organized a series of "trial runs" between November 2000 and March 2001 that attracted more than 500,000 visitors, including virtually all school-age children from the surrounding area. After working out the inevitable bugs that pop up during the initial stages of a project of this size and complexity, we officially opened our doors on 17 March. What excites me most about this project is the enthusiastic team of young people who have dedicated themselves to telling people that plants are important. I think it's the best "learning" exhibit anywhere, especially for school-age children. As scientific director, my job is to see that it's not just a public display that's entertaining, but an educational experience based on sound science as well. Scholarships are provided to students who want to earn a master's or a doctorate degree while working on-site. Although much of their efforts focus on interpretation, these young scientists are also given time and resources for basic research. The Eden Project, in fact, now has six PhDs on staff. My goal is to train skilled research scientists who can also interpret and communicate research findings to the public. We don't have enough science communicators worldwide capable of doing this. This project is designed to serve as a training ground for them.

What is your assessment of the future of biological biodiversity on a global scale?
We have many global initiatives, including the Convention on Biological Diversity that has been ratified by 180 countries. We also have many national governmental agencies and nongovernmental organizations working on this issue. Yet I'm worried about the future of biodiversity because the loss of biodiversity has not slowed despite all these efforts. Many dedicated groups and individuals now realize that the problem is much larger than they ever thought. Such awareness, in a strange way, is good news since it helps put a spotlight on the issue and prevents us from believing that agreements and conventions by themselves define success. One of my biggest worries is that we have not established a sufficient number of nature reserves. Another is that we have not taken sufficient account of climate change and its potential impact of ecosystems. A third worry, as I mentioned earlier, is that we have yet to devise a strategy that is truly multicultural and multidisciplinary. Issues related to biodiversity can only be solved by addressing concerns from a broad perspective. That's the one sure thing we have learned over the past three decades. It's still unclear how we transform that insight into effective research and policy agendas. We have also come to realize that conservation and sustainable use are not poles apart but go together. Again such insights have yet to be transformed into concrete blueprints for reform. Each time we lose a species, we narrow our future options. The plants I work with are the 'green glue' that holds the planet together. It's still not too late but as we decrease the world's biodiversity we weaken the globe's adhesive power. And, at some point, there won't be enough green glue left to hold it all together. ■

HARVARD AND TWAS EXAMINE RESEARCH AND DEVELOPMENT IN THE DEVELOPING WORLD

Between 11-13 September 2001, the Belfer Center for Science and International Affairs and the Center for International Development at Harvard University, in cooperation with TWAS, held an "International Conference on Globalization of Research and Development: Challenges and Opportunities for Developing Countries." The conference, organized under the auspices of the Rockefeller Foundation's "Biotechnology and Globalization" project, examined key issues influencing the use of new technologies in the promotion of sustainable growth in developing countries. About 30 representatives from academia, government, industry, and nongovermental organizations were in attendance. The venue was the resort town of Grado, Italy, located along the Adriatic Sea some 50 kilometers west of Trieste, which is the site of the TWAS secretariat.



"The growing importance of private sector research and the changing roles of universities over the past two decades have spurred new research and development priorities as well as new patterns of institutional cooperation," says Calestous Juma, Director, Science Technology and Innovation Program at Harvard University's Center for International Development.

Juma, who played a key role in organizing the conference, observes that "many of the policies still being pursued by developing countries and international aid organizations are out of date. These policies often neglect the role of local knowledge and the importance of both information technology and knowledge networks, even in marginal areas."

"The conference," he notes, "was intended to provide an opportunity to better understand today's research and development patterns, especially those arising from the impact of globalization. The ultimate goal is to assist developing countries and international aid institutions in the design and application of effective policies for scientific and technological development. We believe that TWAS has been and will continue to be a key player in this effort."

Conference participants pointed to a number of research policy issues that they consider to be of primary importance as academics and decision makers seek to come to terms with the new global environment for research and development. Among these issues are the need to:

- Broaden technological considerations beyond such traditional sectors as agriculture to take account of long-term sustainability challenges in rapidly emerging fields, including public health and infectious diseases, renewable energy, information and communications technologies, and environmental management. Such efforts should be driven by the need to strengthen the links between science and sustainable development.

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• Forge strategies that help developing countries build their own enduring foundations for research and development to address local and national needs. These efforts require a better understanding of the dynamics driving human capital development, institutional innovation, and the intricate relationship between knowledge creation and economic growth.

• Nurture conditions that promote national innovation systems through cooperative frameworks that are both international and interdisciplinary in scope. Today's global economy is often financed and propelled by private capital. As a result, developing countries must examine ways to promote the private sector and then tap its enormous potential for wealth and job creation.

• Enhance human resource development not only by promoting education but also by ensuring that adequate job opportunities exist for a nation's most educated and skilled citizens. At the same time, developing countries must make better use of its wide range of indigenous knowledge.

• Promote capacity building by increasing national investments in research and development, encouraging developed countries to fund research networks in developing countries, and devising policies that foster high technology clusters and university/laboratory/research institute alliances.

While the impact of globalization has often been breathtaking and sweeping in its reach, those attending the conference concurred that a nation's ability to harness the benefits of new technologies frequently depends on a series of modest and mundane steps requiring diligence, flexibility and common sense. That is the message often conveyed by previous successful experiences (see below), and that is the message likely to guide future initiatives. ■

For additional information about the conference, including the conference report, please contact ***Derya Honca***
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APPLYING PHYSICS IN ZIMBABWE

Zimbabwe's successful decade-long effort to create a university-based masters of science programme in applied physics has spurred a steady increase in the number of well-trained physicists who bring a valuable set of problem-solving tools to the industrial work place. The training that these graduates receive, moreover, has given them an opportunity to pursue interesting and productive careers that have proven to be of valuable to their nation as well.

Soon after independence in 1980, Zimbabwe, like many other African nations, experienced an unprecedented surge in public demand for education. Between 1979 and 1989, enrollment in primary schools rose from 820,000 to 2.1 million, and in secondary schools from 75,000 to 870,000. Today, 60 percent of Zimbabwe's children complete 11 years of schooling; before independence, only 30 percent of Zimbabwe's children completed more than 3 years of schooling. Nearly 30 percent of Zimbabwe's 12 million people are now in school.

Before independence, Zimbabwe was ruled by white settlers operating under a racist system that made it difficult for blacks to acquire technical or managerial training. After independence, the exodus from Zimbabwe of skilled manpower (mainly to South Africa) created a labour shortage that was most keenly felt in the industrial sector. At the same time, the need for people with managerial skills enabled virtually anyone with academic training to be appointed to such positions. Many newly appointed managers were inexperienced and, as a result, could not take advantage of their opportunities.

A shortage of managerial talent persisted for about five years during which time the number of graduates from the University of Zimbabwe (the nation's only university at the time) increased from about 300 to 2000 a year. With such a large pool of candidates, industrial firms were now able to choose their employees more discerningly. Engineering students, who were required to attend a management training course offered through the university's business department, quickly filled the employment gap.

Zimbabwe follows the British system of education. High school graduates use an ordinary (O-Level) certificate, which is attained after four or five years of study, for entry into technical training programmes. Before 1987, a dearth of O-Level graduates forced private firms to provide in-service training. After 1987, Zimbabwe produced O-Level graduates at a rate of 100,000 a year. Firms, consequently, could hire graduates who had already received adequate technical training.

Graduates, on the other hand, quickly found that they needed more than O-Level certificates for secure employment. At the very least, they needed a certificate from a technical college. Moreover, those firms that continued to provide training found that their trainees used this experience as a springboard to better-paid positions.

In 1982, Zimbabwe's Ministry of Labour, Manpower-Planning and Social Welfare launched the National Training Levy requiring employers to pay 1 percent of the total wage costs to the Zimbabwe Manpower Development Fund (ZIMDEF). Proceeds served as the basis of grants either for high school graduate employment in industry or in-service training in technical colleges and other institutions.

By the late 1980s, it became clear that most engineering graduates preferred high-level managerial positions to shop-floor supervisory work. Zimbabwe's industries, however, needed personnel who could oversee the work of shop-floor technicians. The University of Zimbabwe's engineering faculty, who should have taken up the challenge, did not.

In 1987, largely due to pressure from industry, the university was preempted by the Ministry of Labour, Manpower-Planning and Social Welfare, which created a bachelor of technology degree at two polytechnic institutions: Harare and Bulawayo. Responsibility for the programme was initially shared by the institutions' departments of applied physics, applied chemistry, applied biology, and electrical technology. In 1989, the government asked the University of Zimbabwe to assume responsibility for the programme. Two years later, Zimbabwe's second university, the National University of Science and Technology (NUST), was founded and the bachelor of technology programme was transferred to NUST in Bulawayo.

At the University of Zimbabwe in Harare, we reached out to a host of public and private institutions to de-

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vise a training programme that would make the skills of our physics students relevant to the work of nonacademic institutions in both the governmental and industrial sectors. As part of this effort, the department distributed 200 questionnaires to which about 40 firms responded. While none of these firms claimed to have physicists on their payrolls, all expressed cautious optimism about hiring physicists. We later discovered that many of the firms, in fact, employed physicists but in positions that did not require physics training. For example, some physicists worked as technical writers or editors; others as salespersons or personnel managers.

Our master of applied physics that was ultimately launched in 1993 (with an inaugural class of seven students) is a two-year programme. The first year, which consists entirely of courses, includes classroom work in material science, computational physics and statistics, quality control, and computer software applications. The second year consists of an industrial-training practicum with an institution or a firm. Domestic institutions participating in this programme include the Scientific and Industrial Research Centre, Zimbabwe Electricity Supply Agency, Standards Association of Zimbabwe, and Zimbabwe Iron and Steel Corporation. Subsidiaries of such major holding companies as Delta Corporation, TA Holdings, as well as smaller private companies, also have joined the training programmes. To date, 27 students have graduated from the programme.

Through the practicum, students gain first-hand experience of the demands required when working in industry. They are, moreover, able to include their work experience on their resumes. And the practicum helps them gain the confidence they need to successfully participate in their post-graduate job hunts.

Tasks that students have been asked to perform include:

- *The Ministry of Energy called on a student to organize an instructional programme for field operatives installing photovoltaic systems in rural areas under a United Nations Environmental Programme's Global Environment Facility (GEF) programme.*
- *An engineering company placed two students in charge of a team working on a US$400,000 project designed to assemble an electrical distribution system for an office tower.*

Government officials, private entrepreneurs and university professors all agree that the master of science in applied physics programme has become a vital component of Zimbabwe's overall industrial development strategy. The programme, in fact, has opened two avenues of success: those graduating as industrial physicists usually have found work in the private sector, while those graduating as applied physicists have often opted for academic careers.

Put another way, the programme has proved that, even in developing countries, physicists can play a vital role in the industrial sector by bringing unique analytical and mathematical skills to the work place.

Developing countries face a multitude of industrial problems. Well-trained physicists with an understanding of the industrial world can become important members of the nation's problem-solving teams. ■

The above article is based on a presentation given by Xavier F. Carelse at the International Conference on Globalization of Research and Development: Challenges and Opportunities for Developing Countries, Grado, Italy 11-13 September 2001.

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SCIDEV.NET: WEB-BASED DREAM BECOMES REALITY

A NEW FREE-ACCESS WEB PORTAL, SPONSORED BY NATURE AND SCIENCE IN COOPERATION WITH TWAS, IS SET TO TAKE OFF THIS DECEMBER. THE FOCUS: SCIENCE AND TECHNOLOGY IN THE DEVELOPING WORLD.

In late September 2000, a group of 15 scientists, science and technology policy analysts, foundation officials and journalists met for an informal weekend at the secretariat of the Third World Academy of Sciences (TWAS) in Trieste (see *TWAS Newsletter*, October-December 2000, pp. 27-29). The focus of their discussion was a proposal to establish a free-access, internet-based network dedicated to reporting and discussing aspects of modern science and technology relevant to sustainable development and the needs of developing countries.

The proposal was drawn up by staff members of *Nature* and based on their experience of running a website that covered preparations for the World Conference on Science in Budapest in the summer of 1999. Our efforts were driven by the premise that those who stand to benefit most from modern science and technology are also those who have least access to information about it.

As a result, such individuals often are left ill-equipped to take part in discussions about science- and technology-related issues, ranging from assessments of the international and regional impacts of global warming through the environmental implications of genetically modified crops to disputes over patent legislation, that profoundly affect their lives. A new website, we believed, would help redress this balance.

Just over one year later, the project is about to reach fruition. Thanks to the support of several international aid agencies and the world's leading science journals, 3 December 2001 is scheduled as the official launch date of *SciDev.Net*, a website that aims to provide a focal point for both authoritative information and informed debate on these issues.

The audience is intended to include all those with a professional or personal interest in the role of science and technology in sustainable development. Such groups include government decisionmakers, nongovernmental organizations, research administrators, journalists, science teachers, and officials in professional scientific organizations and multilateral and bilateral aid agencies.

The goal of *SciDev.Net* is to enhance the ability of all such potential users to engage in informed debate on ways of applying science and technology to sustainable development.

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As a key contribution to meeting this goal, *Nature* and *Science* have agreed to make a limited number of articles – normally accessible only to subscribers – freely available to *SciDev.Net* each week. The articles will be selected on the basis of their relevance to the general themes being addressed by the website. We are seeking similar arrangements with other leading scientific and medical journals.

The content of the website itself will include individual news and feature items on all aspects of science and technology related to development, opinion articles commissioned from individuals engaged in public debates on these issues, links to a wide range of other scientific and technological organisations, and a set of 'dossiers' intended to provide in-depth coverage of specific topics.

The launch of *SciDev.Net* has been made possible by the generous financial support of the UK Department for International Development (DFID), the Swedish International Development Co-operation Agency (Sida), and the International Development Research Centre (IDRC) in Canada. These three agencies have committed a total of $2 million over three years to the website, which also benefits from the active support of the Third World Academy of Sciences.

SciDev.Net has been set up in London as a not-for-profit company and has applied for registration as an educational charity with the UK Charity Commissioners. Under this arrangement, *Scidev.Net* will be run by a board of trustees, most of whom come from developing countries (see next page).

In addition, the activities of *SciDev.Net* will be aided by an international editorial advisory committee, an arrangement that will allow for wide involvement of both stakeholders and user communities in advising on the activities and editorial policies of *SciDev.Net*.

The director of *SciDev.Net*, who reports regularly to an executive committee set up by the board of trustees, is responsible for the day-to-day operation of *SciDev.Net*, including editorial management and contact with sponsoring organizations and user communities. The board of trustees will meet at least once a year to examine the activities of the *SciDev.Net* and explore future plans.

For *SciDev.Net* to operate effectively, we need to receive as much guidance as possible from those in developing countries that are intended to be its main beneficiaries. That is why we have been pleased to have TWAS play such an instrumental role in the development and launching of this site. And that is why we look forward to the active participation of the Academy and its members in the future.

Broad involvement of the developing world in the website will take place through substantive opportunities for user feedback on *SciDev.Net*, majority representation of developing country representatives on the board of trustees and editorial advisory board, and close interaction with scientific organizations, nongovernmental organizations and journalist organizations in developing countries.

In addition, we hope to eventually create 'nodes' or 'outstations' in several developing countries that will help report on scientific and technical develop-

ments in the region (particularly through 'regional gateways' on the homepage of *SciDev.Net*), and to commission dossier articles and other contributions representing a 'South' point of view. These contributions will be presented through the 'regional gateways' on *SciDev.Net*.

Most critical to the success of *SciDev.Net*, however, will be the number of users it attracts and the ability of the website meets their expectations. Registration will be voluntary. But we hope that as many users of the site as possible will choose to do so. All those who register will receive a weekly e-mail alert describing new additions to the website. In addition, the more people who register and use the site, the easier it will be to argue the case for funding to enable its continued operation.

All those concerned about the role of science and technology in development are urged to register – if they have not done so already – at www.scidev.net. Once you have registered, please send us material that you would like mentioned on the website, and let us have your comments and suggestions on how it could be improved.

SciDev.Net will only be of value if it can meet the genuine needs and interests of its users. And only they will be able to tell us whether it is doing so successfully. ■

David Dickson
Director, SciDev.Net
London, UK

For additional information about SciDev.Net, please phone: +44(20)7291.3691, or email: info@scidev.net. SciDev.Net can be accessed at www.scidev.net.

THE FOLLOWING INDIVIDUALS HAVE AGREED TO ACT AS TRUSTEES OF SCIDEV.NET:

- **Fred Binka**, School of Public Health, University of Ghana
- **Louk de la Rive Box**, professor, International Co-operation, Maastricht University, The Netherlands
- **Philip Campbell**, editor, *Nature*
- **Mohamed Hassan**, executive director, Third World Academy of Sciences, Trieste, Italy
- **Donald Kennedy**, editor, *Science*
- **Lan Xue**, deputy director, Institute for the 21st Century, Tsinghua University, Beijing
- **Lydia Phindile Makhubu**, vice-chancellor, University of Swaziland
- **R. A. Mashelkar**, director, Centre for Scientific and Industrial Research, New Delhi, India
- **Sunita Narain**, director, Centre for Science and Environment, New Delhi, India
- **Geoffrey Oldham** (Chair), former director, Science Policy Research Unit, University of Sussex
- **Abel Packer**, director, Latin American and Caribbean Centre on Health Science Information, Sao Paulo, Brazil
- **Hebe Vessuri**, professor, science studies, Venezuelan Institute of Scientific Investigation (IVIC)
- **Anne Whyte**, consultant, Ontario, Canada

Ali A. Al-Shamlan

AL-SHAMLAN HONOURED

• The University of Massachusetts awarded an honorary science doctorate to TWAS Fellow (1987) **Ali A. Al-Shamlan**, director general of the Kuwait Foundation for the Advancement of Sciences (KFAS) May 2001, in recognition of the leadership role he has played in research and education in Kuwait, especially in the reconstruction of the nation's institutions of higher education during the past decade. From 1988 to 1992, Al-Shamlan served as Kuwait's Minister of Higher Education. He had previously held a number of academic posts with Kuwait University, including chair of the geology department, 1975-1978; assistant dean, faculty of sciences, 1978-1982; and dean, faculty of sciences, 1982-1984. He is also a founding fellow of the Islamic Academy of Sciences. Al-Shamlan received an undergraduate geology degree from the University of Puget Sound (USA), master's degree in geology from the University of Texas (USA), and Ph.D. in geology from the University of Kuwait. He has served as TWAS treasurer since 1999 and TWAS vice-president from 1992 to 1998.

IAP AND IAC

• **Albert Koers**, the recently appointed executive director of the InterAcademy Council (IAC), headquartered in Amsterdam, The Netherlands, visited the InterAcademy Panel (IAP) secretariat in Trieste, Italy, on 6 July 2001. TWAS has hosted IAP since May 2000. Koers came to discuss an array of topics of common concern. He said that he envisions a great deal of interaction between IAC and IAP in the future as IAP expands its roster of workshops and conferences and IAC begins to produce a series of studies on science-related issues of global significance. The IAC has asked IAP members for a list of potential candidates to serve on the expert panel for IAC's first study, "Promoting Worldwide Science and Technology Capacities for the 21st Century." For

Albert Koers

additional information about IAC, contact a.koers@iac.knaw.nl. For additional information about IAP, contact iap@twas.org.

INSTITUTES IN MIDDLE EAST

• A group of scientists, led by **Phillip A. Griffiths**, Director of the Institute of Advanced Study, Princeton, NJ (USA), met at the secretariat of the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, 28-29 June, to discuss the prospects for launching 'millennium science institutes' in the Middle East. Representatives from Iran, Lebanon, Turkey and Tunisia were in attendance. Mohamed H.A. Hassan, TWAS executive director and president of the African Academy of Sciences, also participated in the workshop. The effort is part of the Millennium Science Initiative (MSI), launched in 1998 with the assistance of the World Bank for the purpose of helping to build worldclass scientific centres of excellence throughout the developing world. MSI efforts are currently in various stages of development in South America and Africa. This marked the third meeting of the MSI held in Trieste, including a meeting last fall to examine the prospects for fostering such institutions in Africa (see "Scientific Capacity Building in Africa," *TWAS Newsletter*, April-June 2000), pp. 11-16.

AWARD FOR GLOBAL HEALTH

• The International Centre for Health and Population Research (formerly known as the International Centre for Diarrhoeal Research), Dhaka, Bangladesh, has been named the first winner of the Gates Award for Global Health, which seeks to recognize outstanding research on health problems affecting poor populations. The award, which carries a US$1 million prize (the largest cash award of any medical prize), is endowed by Microsoft Founder and Bill Gates and his wife Melinda. The International Centre for Health and Population Research is best known for its development of simple, inexpensive, yet highly effective, oral rehydration salts used to combat acute diarrhoea. The treatments have saved an estimated 3 million lives a year since their use became widespread some 30 years ago. The

Centre was one of 29 institutions profiled in the United Nations Development Programme Special Unit for Technical Cooperation among Developing Countries/ TWNSO/TWAS monograph, *Sharing Innovative Experiences: Examples of Successful Initiatives in Science and Technology in the South*, published in 1998.

Bina S. Siddiqui

SIDDIQUI HONOURED

• **Bina S. Siddiqui** (TWAS Fellow 1989) was the recipient of the 14th annual Khwarizmi International Award given by the Iranian Research Organization for Science and Technology (IROST). Iran's president, Mohammad Khatami, presented the prize at an official ceremony held in Tehran in February 2001. The Khwarizmi International Award is given to outstanding scientists in a broad range of fields, including agriculture, medical science, engineering and the humanities. Bina Siddiqui, who was educated at Sir Syed College and the University of Karachi in Pakistan, is an internationally recognized researcher in the field of natural products chemistry and bioactive natural products isolation and characterization. She is co-director of the University of Karachi's H.E.J. Research Institute of Chemistry, Karachi, Pakistan.

TOURÉ TO WHO

• TWAS fellow (1997) **Yeya T. Touré** has become the Manager of Molecular Entomology within Strategic and Basic Research (STR) in the World Health Organization's Special Programme for Research and Training in Tropical Diseases (WHO/TDR). The programme, which is sponsored by the United Nations Development Programme (UNDP), the World Bank and the World Health Organization (WHO), coordinates, supports and influences global efforts to combat major diseases affecting poor and disadvantaged people. Such diseases include malaria, schistosomiasis, African trypanosomiasis, Leishmaniasis, dengue, lymphatic filariasis, Chagas disease, onchocerciasis, leprosy and tuberculosis. Touré, who was educated in Mali and France, previously served as head of the Malaria Research and Training Centre in Bamako, Mali.

Yeya T. Touré

NIGERIA'S GRANT TO AAS

• The President of Nigeria, Olusegun Obasanjo, has announced that the Nigerian government will donate US$5 million to the endowment fund of the African Academy of Sciences (AAS). The grant, which will significantly boost pan-African science and technology initiatives, is the largest financial contribution ever given by an African government to a science academy. Mohamed Hassan, president of the African Academy of Sciences and executive director of TWAS, notes "the Nigerian government's generous contribution is the clearest example yet of Africa's realization that support for science must be a key component of any long-term economic development strategy." President Obasanjo's announcement was made in Nigeria's capital city, Abuja, on 31 July 2001 during the official inauguration ceremony of the country's international presidential advisory council on science and technology. The 7-member panel, headed by Mohamed Hassan, is to advise President Obasanjo on effective ways of encouraging the development of science and technology in Nigeria, including how to enhance Nigeria's capacity in information and communication technologies and biotechnology. The panel will also offer recommendations on how to use science and technology to foster cooperaton among African nations. For additional information, see "Nigeria's Science-Based Plans for Development," p. 2-4.

WHAT'S TWAS?

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

At present, TWAS has 583 members from 76 countries, 62 of which are developing countries. A Council of 14 members is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a small secretariat of 9 persons, headed by the Executive Director. The secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. UNESCO is responsible for the administration of TWAS funds and staff. A major portion of TWAS funding is provided by the Ministry of Foreign Affairs of Italy.

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 scholarship.

TWAS was instrumental in the establishment in 1988 of the Third World Network of Scientific Organizations (TWNSO), a non-governmental alliance of 154 scientific organizations from Third World countries, whose goal is to assist in building political and scientific leadership for science-based economic development in the South and to promote sustainable development through broad-based partnerships in science and technology.

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 2000 women scientists from 87 Third World countries. Its main objectives are to promote the research efforts and training opportunities of women scientists in the Third World and to strengthen their role in the decision-making and development processes. The secretariat of TWOWS is currently hosted and assisted by TWAS.

WANT TO KNOW MORE?

TWAS offers scientists in the Third World a variety of grants and fellowships. To find out more about these opportunities, check out the TWAS web-pages! Our main page is at: www.twas.org

FELLOWSHIPS

Want to spend some time at a research institution in another developing country? Investigate the South-South Fellowships: .../SS-fellowships_form.html

GRANTS

Need funding for your research project? Take a look at the TWAS Research Grants: .../RG_form.html
TWNSO runs a similar scheme, for projects carried out in collaboration with institutions in other countries in the South: www.twnso.org

EQUIPMENT

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

TRAVEL

Would you like to invite an eminent scholar to your institution, but need funding for his/her travel? Examine these pages, then: .../Lect_form.html .../Prof.html

CONFERENCES

You're organizing a scientific conference and would like to involve young scientists from the region? You may find what you are looking for here: .../SM_form.html