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YEAR 2001
APR-JUN
VOL.13 NO.2

TWAS newsletter

THE NEWSLETTER OF THE THIRD WORLD ACADEMY OF SCIENCES

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

Africa is a rich continent — rich in biodiversity, rich in mineral resources, rich in precious stones. It is also rich in traditional knowledge, especially knowledge associated with indigenous and medicinal plants.

But Africa, as we all know, is also a poor continent. With roughly 13 percent of the world's population, it enjoys only 1 percent of the world's wealth. An estimated 50 percent of Africa's population lives in poverty and 40 percent suffer from malnutrition and hunger. Two-thirds of Africa's land base is degraded and more than half of Africa's population is without safe drinking water. Malaria poses a serious threat in many regions and HIV/AIDS has devastated the youthful populations of many African nations, including Botswana, South Africa, Zimbabwe, where an estimated 25 percent of the adult population is now afflicted with this deadly disease.

Science and Technology in Africa: Pathways To Success

The truth is that stark disparities exist not only between Africa and the rest of the world, but between Africa and the rest of the developing world.

What accounts for Africa's impoverished state? There are many political, socioeconomic and environmental factors. Centuries of foreign colonialism followed by decades of homegrown authoritarian governments. A lack of transparency in economic transactions often accompanied by mismanagement. Unsustainable use of natural resources. Marginal participation in the global economy.

However, there is another factor that may not be as visible or dramatic as those mentioned above but that may nevertheless play a central role in the continent's inability to participate in the global economy, protect its environment and devise sustainable strategies for economic growth. That factor is Africa's woeful shortcomings in science and technology.

By almost any measure, African science and technology is in a dismal state: in terms of the miniscule numbers and inadequate skills of the research and technical personnel; the poor and neglected quality of the infrastructure; the low level of instruction in primary and secondary schools; and the miserly investments in universities and research institutes.

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PUBLISHED QUARTERLY WITH THE SUPPORT OF THE KUWAIT FOUNDATION FOR THE ADVANCEMENT OF SCIENCES (KFAS) BY THE THIRD WORLD ACADEMY OF SCIENCES (TWAS)
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In light of these daunting challenges, what strategies should African nations pursue to advance their scientific and technological capabilities? I would like to suggest a five-step programme.

TWAS Newsletter, Vol. 13 No. 2, Apr-Jun 2001

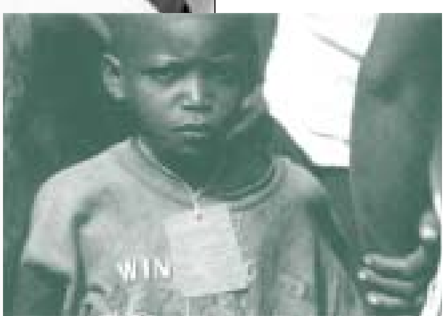
First, develop, sustain and utilize local capacities and leadership in efforts to advance science and technology. *The truth is that developing scientific and technical capacity is less difficult than sustaining it, and sustaining it is less difficult than utilizing it. Yet, the ultimate impact of science and technology depends on all three factors — development, sustainability and utilization. That is why it is important for African nations to invest in the education and training of scientists and technologies, and that is why it is important for each nation to develop an economic strategy that offers scientists and technologists employment opportunities once they obtain their degrees.*

A single talented scientist can make a difference. That is the good news. The troubling news is that past experience indicates educating and retaining scientists and technically skilled workers is much more difficult than it seems. For these reasons, it has become clear that a prerequisite of sustainability is a vibrant educational system and an enduring, yet flexible, job base.

Second, mobilize the best and most relevant science and technology in Africa and elsewhere to address critical social and economic problems. *The food, health and environmental issues faced by people in poor countries, and especially in the least developing countries, are of a different dimension (and often of a different kind) than the food, health and environmental issues faced by people in rich countries. Such differences help to explain why science and technology initiatives in developed countries rarely have targeted Africa's most critical problems — those related to poverty, food and energy deficits, inadequate and unsafe drinking water, tropical diseases, and the HIV/AIDS pandemic.*

As a result, if Africa expects to use science and technology to tackle its most pressing problems, it must develop its own scientific and technical capacities. Otherwise, it will be forever beholden to "second-hand" science that likely will never quite fit the continent's circumstances.

That's not to say African nations should turn their backs on research taking place beyond their borders. In fact, efforts should be made to strengthen poorly funded, yet relevant, programmes within United Nations organizations. At the same time, African nations should also continue to pursue cooperative projects with constituencies that have special ties to the continent. For example, sub-Saharan African scientists should seek to tap the distant yet potentially strong ties that exist between them and expatriate scientists of African origin in the North.



Third, build a strong case for supporting indigenous development of science and technology in Africa. *This is a critical challenge for African scientists given the competing demands that are constantly being exerted on the continent's limited financial resources. African scientists not only have an obligation but a self-serving interest to convince governments of the value of science and the need to support such endeavours. Such efforts must include a willingness to engage the public in discussions on science-based issues, a desire to lobby the government for support, and, perhaps most importantly, a commitment to pursue research agendas that focus on*

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critical social and economic problems — that is, agendas that allow scientists to use their knowledge and skills to help their nations build stronger and more sustainable societies.

Fourth, share innovative and successful experiences in the development and application of science and technology. *Africa's successful experiences in the application of science and technology for development all-too-often have been drowned out by the din of dismal news concerning the current state-of-affairs in the continent. Identification of genetic molecular markers for improved tea harvests in Kenya, ongoing efforts to examine alternative treatments for river blindness in Uganda, research on sickle-cell anemia in Ghana, and detailed assessments of the effectiveness of medicinal plants in the treatment of diabetes in Madagascar are examples of science-based initiatives that deserve greater recognition both within the larger scientific community and among the public.*

Fifth, strengthen and build centres of excellence in Africa. *Despite the general dismal condition of scientific and technological institutions in Africa, small pockets of strength can be found. For example, such national and regional centres of scientific excellence as the Immunology Laboratories in Cameroon, the African Centre for Meteorological Applications in Niger, and the African Centre for Technology in Senegal could be transformed into international centres of excellence capable of functioning more effectively than they do now. Such a transformation would not only boost science in Africa but could serve as models for the development of other institutions across the continent.*

The major problems that have afflicted Africa during the past three decades of the 20th century remain stubbornly in place at the beginning of the 21st century. To address these problems and avoid even greater marginalization, Africa must devise new long-term visions and strategies that enable it to sustain economic growth and compete in a world where development is becoming increasingly dominated by scientific knowledge and technical skills.

In short, African nations must build and sustain their own capacities in modern science and technology and then use the knowledge and skills that are acquired through such efforts to devise problem-solving strategies. Such strategies, in turn, must put the best of science and technology in Africa and elsewhere to work in ways that will build and sustain local and regional capacities as well as address real-life concerns.

The bottom line is this: Science and technology alone cannot save Africa but Africa without science and technology cannot be saved.

Mohamed H.A. Hassan
Executive Director, TWAS
President, African Academy of Sciences

BIODIVERSITY'S IMPORTANCE IN DRYLAND REGIONS

Gloria Montenegro

Drylands, habitats that range from oceans of sand in sub-Saharan Africa to glacial mountains in Mongolia, cover about 40 percent of the world's surface. Such lands are found in more than half of the world's countries and are home to more than 1 billion people. As a result, it is indeed opportune and important for the Third World Network for Scientific Organizations (TWNSO), with the help of TWAS, to organize and coordinate the "networking" project "Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones," which was launched last year and is scheduled to continue until 2002 (for additional information about the project, see "Dry Diversity," p. 15).

Depending on the levels of rainfall, drylands come in many different varieties, including deserts, semi-deserts, savannas, grasslands, shrublands, and dry forests. For example, Mediterranean-type climates, found in Italy and Greece as well as the southern coast of California in the United States and the mountains of central Chile, share many characteristics common to dryland ecosystems.

Organisms living in such nutrient-deprived ecosystems often face common environmental stresses due largely to persistently low levels of rainfall and periodic droughts. As a result, optimal conditions for growth usually are restricted to brief intervals in spring. Despite such adverse conditions, dryland ecosystems are remarkably rich in biodiversity. Indeed the diversity of species found among Mediterranean-climate floras is more than double that of the Amazon basin.

This rich biodiversity, however, is increasingly at risk. Human activities related to urban growth, overgrazing, the spread of invasive species, excessive plant collecting, destructive logging practices, and even fire are responsible for some of the problems; climate change, particularly global warming, is another major culprit.

Eleven of the 25 areas that the Conservation International Foundation in Washington, D.C., has identified as "biodiversity hotspots" — places teeming with endemic species but acutely threatened by human activities — are located in arid, semiarid and subhumid areas. These areas include the Cerrado in Brazil, central Chile, California's floristic province, Madagascar, the eastern mountains and coastal forest of Tanzania and Kenya, the western edge of South Africa and Namibia, the Caucasus, south-central China, and southwest Australia.

Moreover, researchers working with Conservation International, estimate that population growth in zones designated as dryland biodi-

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versity hotspots will increase at a rate of 1.8 percent a year, substantially higher than the population growth rate of the world as a whole (projected at 1.3 percent a year) and even exceeding the estimated population growth rate in developing countries (projected at 1.6 percent a year).

Such trends suggest that dryland regions will experience increased pressure by human activities in the years ahead. This pressure, in turn, will cause more and more exploitation of dryland resources and a corresponding loss in the productivity of the land.

The key to conserving fragile ecosystems lies in promoting their wise use. Because people living on these lands exploit indigenous resources both to survive and improve the quality of their lives, reconciling conservation with exploitation will not be easy.

Emphasis must be placed on working with small communities rather than national or provincial governments. Such strategies are the only way to ensure that the interests of local people are taken into account. The fact is that any integrated programme of biodiversity conservation and sustainable use must ensure that local communities and host countries receive maximum benefits from their biological resources. This can take place only if conservation and development strategies are based on traditional knowledge.

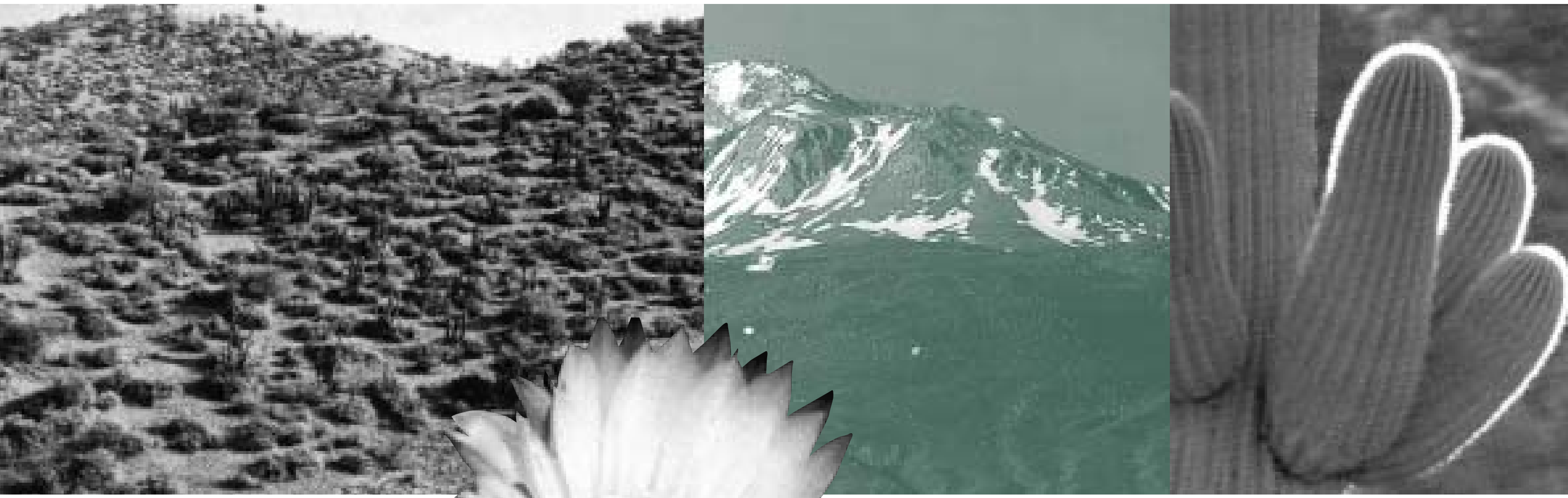
To achieve this goal, we must:

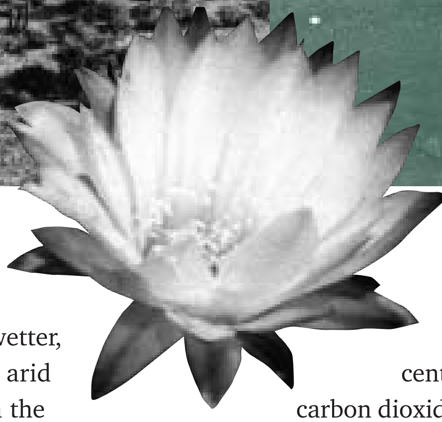
- Raise public awareness of conservation.
- Promote education at all levels of society focusing on the value of biodiversity.
- Help people develop their own management strategies for the sustainable use of these resources.

Beyond the sustenance and services that it provides to the people who live there, dryland biodiversity carries a great deal of global scientific importance because of the extraordinary environments in which these resources have developed and evolved. Dryland plants have adapted to environmental stresses associated with searing drought, scorching heat, chronic nutrient deprivation, and ultraviolet radiation.

To cope with these difficulties, these plants produce a complex array of natural products designed to help them survive under extreme conditions. Many of the chemical compounds developed as a natural response harbour medicinal properties that have proven beneficial in the fight against human diseases and illnesses. That, in turn, has enhanced the value of these species throughout the world.

The Earth is now warmer than it has been at any time during the past 600 years. In fact, the 1990s proved the warmest decade of the 20th century. Global precipitation





patterns also have changed. While most areas have become wetter, some (including the arid and semiarid regions in the Middle East, the northern and southern regions of Africa, and the western coast of Latin America) have become drier.

We must develop better tools to improve predictions of how global ecosystems will be altered by environmental pressures induced by atmospheric and climatic change and, more specifically, how climate change acts as a powerful selective agent on plant traits. Such international accords as the Convention of Climate Change and the Convention of Biological Diversity, which seek to address these complex issues, deserve the full backing of national governments and the international community.

Over the last two centuries, accelerating rates of fossil fuel use and forest clearing by humans have led to increasing concentrations of carbon dioxide (CO_2) in the atmosphere. From preindustrial concentrations of 280 parts per million (ppm), atmospheric CO_2 rose to 364 ppm at the end of the 1990s (an increase of 30 percent). The figure is likely to double, compared to preindustrial concentrations, within the next century.

These trends are significant, especially when considering how plants respond to elevated CO_2 levels in the atmosphere and how such changes often affect the colonization of invasive plants in climate-altered habitats. If invasive species prove more successful at adapting to habitats with increased CO_2 concentration in the atmosphere, natural communities dominated by native and endemic species will be adversely affected. Scientists, in fact, now recognize invasive species as the agents responsible for significant losses of biodiversity. Global change is likely to accelerate these losses by increasing disturbance and placing additional stress on native species.

Successful ecosystem management depends on knowing detailed characteristics of the biota of a given landscape and on understanding how the biota responds to climate variability and changing land use patterns. Thus the search for management strategies to ensure the sustained utilization of dryland natural resources has only just begun. ■

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ACADEMIES IN AFRICA

IAP'S FIRST WORKSHOP IN TRIESTE SOUGHT TO RAISE THE PROFILE OF SCIENCE IN AFRICA BY STRENGTHENING NATIONAL ACADEMIES IN AFRICAN COUNTRIES WHERE THEY CURRENTLY EXIST AND ENCOURAGING THEIR CREATION WHERE THEY DO NOT.

"Capacity Building for Academies in Africa" was the theme of an InterAcademy Panel (IAP) workshop held in Trieste, Italy, 16-18 May 2001. Approximately 40 participants, including four African ministers of science and technology, attended the meeting, which marked the first InterAcademy Panel activity to take place in Trieste since the Third World Academy of Sciences (TWAS) was selected to host the IAP secretariat last June.

Mohamed Hassan, executive director of TWAS and president of the African Academy of Sciences, set the stage for the discussions that followed when he noted in his opening remarks that "Africa, a continent with nearly 1 billion people, has less than 30,000 African-born Ph.D. scientists living and working there. At the same time, of the 53 nations that make up the continent, only nine have established independent merit-based science academies."

"It's clear," he went on to say, "that both well-trained scientists and strong scientific institutions are in short supply in Africa and that the absence of one helps to explain the absence of the other. Africa, simply put, has too few science academies. Those academies that do exist, moreover, must be strengthened. Specifically, more funds must be invested in academy research and training activities and academies must play a larger, more authoritative, role in advising their governments."

"Because so little science is being done in Africa," notes Yves Quéré, foreign secretary of the French Academy and co-chair of the IAP, "many nations there do not have the critical mass of scientists that is necessary to create and then sustain an academy. The

absence of science academies only adds to the sense of isolation that many African scientists feel. As a consequence, it is much more difficult for them to exchange information and learn from one another — essential elements of scientific progress both for individuals and societies."

The workshop was designed to lay out a broad agenda for advancing three interrelated goals: to strengthen science academies among those nations in Africa where they do exist; to spur the creation of academies among nations in Africa where academies do not currently exist but where the number of scientists is large enough to support an academy; and to pursue alternative strategies — for example, the creation of science associations or regional academies — among African nations that have too few scientists for a national academy to succeed.

Of the 53 nations that make up Africa, only nine have established independent merit-based science academies.

Beyond the call for more active and numerous science academies in Africa, the workshop concluded with a series of recommendations highlighted by the following two action items:

- Academies in Africa should build a network facilitated by a website to be managed by the African Academy of Sciences.
- Each government in Africa should be encouraged to create an endowment fund large enough to generate an annual return on principal that would cover an academy's yearly administrative costs and baseline activities, thus ensuring its long-term survival, independence and impact.

Much of the workshop was devoted to exploring the current state of science academies in Africa and examining the experiences of other science academies — ranging from the Royal Society in the United Kingdom, established in 1660, to the Brazilian Academy of Sciences, established in 1916, to the Malaysian Academy of Sciences, established in 1994. Such discussions were all part of a larger effort to determine what African science academies could learn both from each other and from the experiences of science academies in other parts of the world.

Not surprisingly, participants revealed that although all academies share the same goals — honouring and rewarding scientific excellence, promoting the advancement of science, increasing public awareness of the value of science, and providing advice to governments on science-related issues — they are not all cut from the same cloth. There are, for instance,

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SCIENCE IN NIGERIA

Among the participants at the IAP Workshop on Capacity Building for Academies in Africa was Turner T. Isoun, Nigeria's Minister of Science and Technology, who is responsible for overseeing science and technology policies in one of Africa's most important and potentially influential nations. With more than 120 million people, a treasure trove of natural resources (including Africa's largest oil reserves) and deeply rooted traditions in education, Nigeria's economic and social well-being were seriously damaged by 15 years of dictatorial military rule that afflicted the nation between 1983 and 1998. Today, Nigeria, which has established an energetic but fragile democratic government, is again exploring strategies for rebuilding and strengthening its science and technology enterprise.

Many observers of African science and technology believe that Nigeria, because of its size, wealth of resources, and potential scientific prowess, could play an instrumental role in the revival of Africa, particularly sub-Saharan Africa. Fabio Pagan, a science writer with the public information office of the Abdus Salam International Centre for Theoretical Physics, Trieste, Italy, had an opportunity to discuss the current state and future direction of science and technology in Nigeria with Minister Isoun during his recent visit to Trieste to attend the IAP workshop. Excerpts follow.

What are the major problems facing scientists and scientific institutions in Nigeria and other African nations today?

Africa has its own culture and its own way of doing things. We must accept and respect that. But scientific culture and attitudes are universal, especially when it comes to problem-solving. If African nations, including Nigeria, are to be successfully involved in science and technology initiatives, we must change our attitudes and our old ways of doing things and become more willing to adopt and apply universal scientific methods of thinking and behaving. That is one of the most fundamental challenges that African nations, including Nigeria, face in their efforts to embrace science and technology. Another major challenge is the development of effective strategies for fostering both individual and institutional capacity. Each nation has a responsibility to build a strong foundation in education and

vast disparities in budgets, ranging from multimillion dollar annual budgets for academies in Europe and the United States to yearly budgets that total several thousand dollars for academies in Africa. There are also vast disparities in membership: For example, the Royal Society (UK) has 1300 members, the Royal Swedish Society 364, and the Nigerian Academy of Sciences 97.

The structural framework of academies, moreover, varies from country to country. In the United States, there are actually three academies — for science, engineering and medicine. In France and many other European countries, academy members come from a multiplicity of disciplines ranging from physics to literature. In Hungary's two-tiered membership framework, all individuals who earn a Ph.D. are made "doctors" of the academy, while those who have made noteworthy contributions to science are elected "members." In Mexico, any scientist who has published at least 10 articles in peer-reviewed international journals is eligible for election into the Mexican Academy of Sciences; a member may also be expelled if he or she has not published an article for three years. In

Egypt, there are two academies: one whose sole purpose is to select individual scientists for membership and another that is institution-based consisting of some 250 research councils and committees.

The point is that science academies come in many different shapes and sizes and that African nations wanting to reform their existing academies or to create academies for the first time have a relatively large number of models from which to choose.

What the workshop also revealed is that the science academies currently found in Africa, despite sharing a common set of problems, also vary to some extent in membership, structure and purpose. As Shem O. Wandinga, president of the Kenya National Academy of Sciences, observed: "There is no foolproof prescription for ensuring the health and vitality of a science academy."

Of the nine science academies currently in existence in Africa, the National Malagasy Academy, created in 1902 when the nation was under French rule, is the oldest. The Senegalese Science Academy, launched in 1999 during the TWAS 7th General Conference held in Dakar, is the youngest. The Academy of Science of South Africa, created in 1996 soon after the end of apartheid, has adopted an aggressive strategy for expansion hoping to boost its membership from 215 to 800 over the next five years. The Cameroon Academy of Sciences, launched in 1991, has just 45 members and no immediate plans for rapid expansion. The Kenya National Academy of Sciences, meanwhile, has an annual operating budget of approximately US$100,000; the Cameroon Academy US$10,000.
Overall, here is the current scorecard on science academies in Africa:

- Nations with academies: Cameroon, Ghana, Kenya, Madagascar, Nigeria, Morocco, Senegal, South Africa, and Uganda.
- Nations with concrete plans to establish academies: Tanzania, Tunisia, and Zimbabwe.
- Nations that do not currently have the resources or critical mass of scientists necessary to support and sustain academies but would nevertheless be prepared to participate in associations or networks that may help boost the activities of both their enterprising scientists and scientific enterprises. Among these nations are: Benin, Botswana, and Namibia.

technical training. A growing number of African nations have expressed a willingness to provide sustained funding for these activities and this is an encouraging sign.

Beyond changes in thinking and infrastructure, African nations should concentrate on specific scientific and technological areas that promise the largest returns on investment. In this regard, I think there are two areas that demand special attention. The first is information technologies. Africa largely missed the industrial revolution — at great cost to the continent's economic and social well-being. Now we cannot afford to miss the information and knowledge-based revolution. Africa's scientists must be active participants in this revolution and Africa's people must be prime recipients of its benefits. Nigeria has devised a comprehensive plan for the advancement of information technologies within the nation and the government is committed to implementing the plan's wide-ranging proposals, many of which focus on the need to provide internet access to students, especially those in universities. The second area of critical importance is biotechnology, which is closely related to issues of food security, public health, and the environment. Other areas that deserve our attention include material science, which could have important implications for information technologies, and the development of databases, particularly in such areas as medicinal plants and mineral resources. The important thing to keep in mind, however, is that all African nations face chronic financial shortfalls and are buffeted by immediate social and economic crises. Such factors make it essential for advocates of science and technology to establish and adhere to a small list of priorities. Success stories, which serve as concrete, easily understood, examples of our accomplishments, are critical to our long-term progress. Such stories are invariably the product of commitment, discipline and focus.

Nigeria has quite a number of universities and polytechnic institutes. What can be done to encourage students to remain in Nigeria?

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You are right; we do have a fair number of institutes of higher education. Yet we have had a difficult time encouraging our most gifted and educated citizens to stay and work at home. During the 15 years of military dictatorship that we experienced from 1983 to 1998 there was little — and often no — funding for educational institutions. Because these institutions were starved for funds and operated in stifling anti-intellectual environments, many good people left. Today, Nigeria has a democratic government. Our president, Olusegun Obasanjo, is committed to reforming the educational system. He is particularly interested in making scientific and technological education and training a priority. The hope is not only to train a new generation of Nigerian scientists and technologists who will find sufficient opportunities to stay in their home country but to improve conditions to the point that members of Nigeria's Diaspora will return. It's a daunting challenge but the Nigerian government is determined to take steps to turn the brain drain problem into a brain gain opportunity.

Nigeria has faced tribal conflicts that have posed risks to the nation's political stability and social harmony. What impact have such conflicts had on the nation's scientific community?

This is a very interesting question. In the IAP workshop, we have spent a good deal of time discussing the relationship between freedom and democracy and science and technology. Most of the participants agree that these forces have been closely related throughout history. When a nation builds and maintains a strong foundation in freedom and democracy, it creates a more stable platform for making progress in science and technology. Equally important, when a nation has a democratic government, it can better manage cultural and ethnic diversity — and, ultimately, address issues of poverty more effectively. If poverty is rampant, you are more likely to have conflict, including tribal conflict. I think that the best way to ensure progress on all fronts is to first nurture and sustain democratic principles and values. In Africa's case, that means the promotion of good government responsive to the needs of the people. In such an environment, the promotion of science and technology will be a high priority.

The history of academies is rooted in the need for scientists to communicate with one another. The good news is that such exchanges of information need not be too expensive. But as Samuel Ofosu-Amaah, vice president of the Ghana Academy of Arts and Sciences, P.E. Mugambi, interim secretary of the Uganda National Academy of Sciences, and others emphasized, for science academies to be successful they need a sufficient level of funding that they can count on year-in and year-out.

That's why so many workshop participants expressed interest in the financial framework established to support the Malaysian Academy of Sciences. The academy was launched in 1994 with a US$5 million endowment fund established by the Malaysian parliament. Interest from the fund has provided the academy with sufficient revenues to cover operational and core programmatic costs.

"The endowment," Dato Lee, vice president of the academy, noted during his presentation at the workshop, "has not only ensured our survival but has allowed us to escape the vagaries inherent in the gov-

ernment's annual budgetary process. At the same time, it has allowed us a degree of independence to examine science and technology issues in ways that both enhance our prestige and the usefulness of our published reports for decision-makers."

"We all know that the promotion of scientific excellence is critically important to the long-term economic and social well-being of our nations," says B.S. Ngubane, South Africa's Minister of Arts, Culture and Science. "But more immediate concerns must be addressed first and foremost. That doesn't leave much in the way of funding for scientific institutions that many people view as ivory-tower retreats for the nation's elite. The reality is that African nations need to marshal academic expertise to focus on quality-of-life issues. Vigorous, adequately funded science academies attentive to their nation's economic and social concerns could play a vital role in this effort."

For this reason, most workshop participants agreed that it was critical for proponents of science academies to urge their governments to support such institutions.

Over the past several decades, Africa has faced considerable challenges when it comes to scientific communication. What is the situation today?

The situation has improved a great deal. In the late 1980s and early 1990s, I spent several years in Kenya in east Africa. At the time, communications in east Africa were better than in west Africa, where up-to-date electronic communication systems were extremely scarce and unreliable. During the past 10 years things have improved considerably. Today, telephones, e-mail and faxes are widely available and becoming easier to access all the time. Take Nigeria for example. We have recently negotiated with several companies to help us build a GSM (Global System for Mobile Communication) network that we hope will increase the number of phones from 800,000 to four million over the next few years. We view this effort as only the beginning. It is our goal to make modern information technologies available in every part of Nigeria and to encourage other African countries, both in the West and East, to participate fully in the information technology age. If we succeed on this front, I believe our communications infrastructure will become strong enough to nurture a network of African technologists, scientists and intellectuals who can communicate freely with each other and with their counterparts in other parts of the world. Such communications will benefit not only African countries but countries throughout the developing and developed worlds.

With which countries would you most like to forge partnerships?

Nigeria is an English-speaking country. English, in fact, is our national language. That provides us with easy entry to such countries as the United States and the United Kingdom with whom we feel a natural affinity. But we are also fortunate to live in an age in which English has become the universal language of science. That should give English-speaking countries like Nigeria an advantage in forging scientific exchanges and partnerships with countries throughout the world. We remain acutely aware of the need to respect and preserve languages other than English. In fact, we have made efforts within Nigeria to preserve our indigenous languages. We are also aware that rapid progress in electronic sound-sensitive translation systems means that we should be able to easily interact with colleagues

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in Europe, Asia and South America, where English is not the primary language. Nevertheless we hope to take full advantage of our status as an English-speaking country to promote interaction with scientists throughout the world. The simple answer to your question is that international scientific partnerships and networks are likely to increase rapidly and Nigeria hopes to fully participate in these efforts.

What role do you think the IAP will have in the future of academies in Africa?

This IAP workshop, which is the first one to be organized since the IAP secretariat was placed under the administrative umbrella of TWAS, is an important event. One of IAP's primary mandates is to help countries that have weak science academies (or none at all) to develop active and vibrant institutions. When you realize that Africa, a continent with 53 nations, presently has only nine national science academies, no one can doubt the need to address the major underlying theme of this workshop: capacity building among scientific institutions in Africa through the strengthening and creation of science academies. Regional academies such as the African Academy of Sciences (AAS) and international academies such as TWAS have been crucial to the well-being of science academies in Africa and will likely play a key role in the creation of new national academies. The fact is that many African nations will not be able to launch their own academies without a helping hand from others. The political will and financial support for the creation and further development of academies must come largely from each nation. Nevertheless institutions like AAS, TWAS and now IAP could play a critical role in sharing the experience and expertise that they have acquired in building and promoting their own academies. Such networking and information exchange will likely prove indispensable in efforts to promote science academies in Africa — and, perhaps more importantly, will likely serve as a key element in advancing science and technology among African nations that now seem increasingly eager to join and fully participate in the global scientific community. ■

"The good news is that there is increasing recognition that the development of science is the only sure way for nations to improve their well-being in a world increasingly defined by economic globalization and information technologies," says Césaire Rabenoro, President of the National Malagasy Academy. "As a result, governments in Africa have become more receptive to arguments that call for additional investments in science and technology. One of the keys for those advocating the creation and strengthening of science academies in Africa is to convince government officials that such institutions can make concrete contributions to their nations' well-being. That means both the promotion of scientific excellence and the application of scientific thinking in the service of society. The two goals, in fact, work hand-in-hand in enhancing an academy's prestige."

Events such as the IAP Workshop on Capacity Building for Academies in Africa can assist academies, particularly emerging academies in Africa, in advancing these twin goals. By learning from the experience of other academies and having institutions like the IAP and the African Academy of Sciences help youthful academies in African nations make their case for securing financial support from their governments, there is a chance that science academies could gain a stronger footing within their societies and ultimately play a steadier, more important role in the future of Africa's development. ■

For additional information about the IAP Workshop on Capacity Building for Academies in Africa, please contact ⇢ ***Joanna Lacey****, IAP Secretariat*
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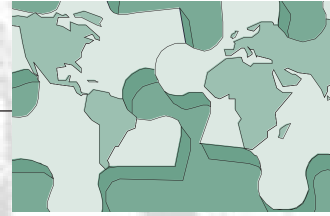

DRY DIVERSITY

A TWNSO PROJECT, FUNDED BY THE GLOBAL ENVIRONMENT FACILITY, HOPES TO IMPROVE OUR KNOWLEDGE OF THE RICH BIODIVERSITY FOUND IN THE WORLD'S DRYLAND REGIONS — AND TO PROMOTE STRATEGIES TO BETTER MANAGE THESE VALUABLE RESOURCES.

When people think of drylands, they think of parched landscapes devoid of the diversity of life that we associate with more humid environments. Researchers, however, are discovering that arid and semi-arid areas, which cover more than 40 percent of the globe's total land surface are, in fact, rich in biodiversity.

As knowledge of the flora and fauna found in "rain-deprived" regions increases, so too have concerns for protecting dryland biodiversity. Such diversity often serves as the basis of survival and economic well-being for the more than 1 billion people who live in arid or semi-arid zones around the world.

Learning more about dryland biodiversity from the people who live there and creating programmatic frameworks that allow them to share their experiences are the primary goals of the Third World Network of Scientific Organizations (TWNSO) project, "Promoting Best Practices for Conservation and Sustainable Use of Biodiversity of Global Significance in Arid and Semi-Arid Zones." The two-year project, which is funded by the United Nations Environment Programme (UNDP) Global Environment Facility (GEF), held its first "all participants" meeting from 4-6 April 2001. Some 30 people hailing from 15 nations attended the event.

"Drylands have only recently begun to receive the attention that they deserve," says Hassan Hassan, an environmental specialist with the World Bank, who is a member of the project's advisory committee. "For too long, drylands were considered barren lands inhabited by some of the world's poorest people." While it is true that 8 of the world's 10 most impoverished nations are located in arid or semi-arid regions, it's also true that the people who live in such areas display a resilience and creativity that has often been ignored by officials from their own governments and the international aid agencies seeking to help them. Viewed as marginal lands inhabited by marginal people, policies and programmes were sometimes put in place that failed to take account of centuries of local experience and accumulated knowledge in dealing with these harsh environments.

"The image both of dryland habitats and the people who live there has changed dramatically over the past decade," adds Gloria Montenegro, another member of

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the project's advisory committee. Montenegro, professor of agronomy and forestry at the Catholic University of Chile, has conducted extensive research on the state of biodiversity in the semi-arid mountainous zones of her native country and throughout much of Latin America (see "Biodiversity's Importance in Dryland Regions," p. 5.)

On the one hand, she notes, "dryland ecosystems, once thought to be largely barren and lifeless, are increasingly viewed as places teeming with life." On the other hand, "dryland inhabitants, whose lifestyles and resource management practices were once considered destructive, are viewed increasingly as wise stewards of the land."

Arid and semi-arid areas cover more than 40 percent of the globe's total land surface.

These "altered assessments" of arid and semi-arid environments and traditional resource practices of the people who have resided there for generations have prompted scientists and officials of international assistance organizations to re-evaluate the policies and programmes that have been implemented in the past to improve environmental and economic conditions in dryland zones.

"When issues related to drylands first became part of the global environmental agenda some 20 years ago," notes Hassan, "researchers and public officials focused largely on the spread of deserts due to poor resource management practices and population pressures." Today many scientists believe that past projections of the spread of deserts were overestimated. As Hassan observes, "the increase in dryland areas that has taken place over the past few decades not only has been due to poor resource management practices but also has stemmed from changes in weather and climate."

How a problem is perceived has consequences for how programmes are implemented. That certainly was the case when it comes to dryland policies. During the 1970s and into the 1980s, especially in the aftermath of the severe Sahel drought, such international organizations as the United Nations Environment Programme, the United Nations Development Programme and the World Bank, concentrated their efforts on physical remedies designed to stem the tide of desertification. Investments in tree-seeding, land terracing and earthen dams, for example, were the order of the day.

"These efforts," observes Hassan, "did have some

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benefit but not nearly as much as the proponents had hoped." The reasons for the programmes' shortcomings were manifold but two factors proved particularly revealing. First, the programmes focused on a problem that did not really exist: the inaccurately perceived endless expansion of deserts; and, second, these "top-down" initiatives, often devised by officials residing in national capitols or international cities far from the desert lands themselves, did not encourage the active involvement of the people who were targeted for assistance. As a consequence, when project funds dried up, so too did local enthusiasm for the project.

"Today," Hassan notes, "we recognize that deserts — like tropical rain forests or coastal plains — are an enduring part of the global landscape." As a result, it is now recognized that the overall goal should be to devise policies that allow people to better adapt to their environment, not to radically change the environment into something that is ultimately incompatible with the forces of nature.

"To advance this goal," Hassan observes, "we need to draw on the knowledge of the people who live in the environments we are seeking to help. Abstract theories and textbook studies are no substitute for on-the-ground experience from people who call these environments their home."

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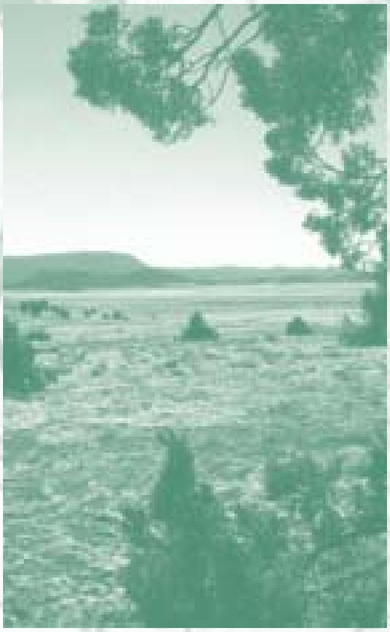


The Convention to Combat Desertification, first presented at the Rio Earth Summit held in Brazil in 1992 and since ratified by 180 countries, acknowledges the importance of local citizen participation in efforts to improve the environment and economy of arid and semi-arid zones. In fact, the convention explicitly states that no progress will be made on issues related to arid and semi-arid zones without the direct support of national governments and the active involvement of local populations.

Dryland degradation costs developing countries an estimated 4 to 8 percent of gross national domestic product each year.

Like the convention, the GEF project also draws on the principles of local participation and involvement as the centerpiece of its efforts. "The grant proposal," says John Lemons, an expert in global environmental issues who is the project's lead consultant, "has three major goals: to identify and disseminate best practices for the conservation and sustainable use of biodiversity resources in arid and semi-arid ecosystems; to increase South-South collaboration among centres of excellence focusing on the management of biodiversity in dryland regions; and to assist the efforts of local populations to oversee and sustainably utilize such fragile ecosystems."

To fulfill these goals, the project design calls for the organization of four regional workshops and one international conference to explore in-depth the complex environmental, economic and political issues that surround efforts to conserve and sustainably use the biodiversity of dryland regions; the creation of a website to allow participants and others to exchange information on issues of common concern; the publication of a monograph that describes in detail the successful experiences in resource management that each of the participants have been involved in; and, ultimately, the creation of an institutional network focused on this issue that will continue to function long after the grant project comes to end in 2002.

"Many of the project's participants," Lemons says, "have had first-hand experience in efforts to conserve and effectively utilize biodiversity in these rich, yet often unforgiving, environments. Through this project, we hope to encourage them — and eventually others — to share their experiences and learn from one another."

As one example, Lemons points to efforts in the small Middle Eastern country of Oman to preserve the life-giving but highly vulnerable lagoons that exist within this nation's largely desert lands. "After years of neglect," Lemons notes, "the government of Oman has devised what promises to be a successful strategy for

the protection of the remaining healthy lagoons. The effort, built on the principles outlined in the Convention to Combat Desertification, draws on national and international scientific expertise, public involvement and sensible financing, to create a plan that is both environmentally and economically sound" (see "Desert Wetlands Preserved," p. 20).

"The conservation and wise use of the world's drylands," claims Hassan, "has an importance that extends beyond environmental issues. Dryland degradation, for example, costs developing countries an estimated 4 to 8 percent of their gross national domestic product each year." The overall economic impact, moreover, is often not confined to a particular region or nation. "During periods of extreme drought," Hassan adds, "it is not unusual for thousands, and sometimes hundreds of thousands of people, to emigrate to more hospitable environments either in cities within their own country or less stricken areas in foreign nations. That places additional economic — and environmental — pressures on already fragile, overburdened areas."

And that is what makes this GEF project on "the conservation and wise use of biodiversity on arid and semi-arid lands" at once so important and so challenging. Efforts to protect and promote dryland resources involve science and policy, international experts and local citizens, short-term incentives and long-term strategies, and a knowledge both of site-specific conditions and broad global trends.

No one individual or institution can hope to address such a vast array of concerns. But an active network of institutions — all with experts experienced in dealing with issues related to dryland biodiversity — may provide a framework that allows its members to help one another to improve their ability to meet the environmental and economic challenges that they face today — and are likely to continue to face in the future.

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DESERT WETLANDS PRESERVED

The Sultanate of Oman is a small arid country that lies in the shadow of Saudi Arabia on the southeast coast of the Arabian peninsula. High rugged mountains to the north and south are divided by a broad desert of sand and gravel that stretches for some 1000 kilometres across the nation's midsection. Beneath the stark environment of Oman's interior high plains are the nation's rich oil and natural gas reserves that help provide its 2.5 million citizens with an average annual per capita income of US$7700, a figure equal to Hungary's.

"Oman's lack of rainfall, averaging about 10 centimetres a year, makes the nation's sources of water even more important than in other nations where rainfall is more plentiful," says Reginald Victor, professor of biology and newly appointed director of the Centre for Environmental Studies and Research at Sultan Qaboos University in Oman. Victor was one of the participants in the TWNSO workshop on biodiversity in drylands held in Trieste this past April.

"That's why," Victor adds. "Oman's sand-separated lagoons, located along the nation's southern coastline near the city of Salalah, are so important. These lagoons not only serve as life-giving pools of water for fauna and flora but also provide the basis of a unique ecosystem nurturing a broad range of biodiversity."

In fact, the lagoons, which sit between the Arabian Sea and inland seasonal rivers, are neither fresh- nor salt-water ecosystems. Instead, they lie in a transitory environment that changes from one ecosystem to another from time to time.

Victor describes the dynamics of the lagoons' ecosystem this way: "The seasonal rivers remain dry for much of the year. Meanwhile, the lagoons, buffered by sand barriers, often are separated from the sea for long periods — sometimes for as many as five to 10 years. That means, over time, the lagoons become more and more like freshwater environments."

In fact, during these tranquil periods, the lagoons function much like freshwater lakes providing water and other precious ecological products and services for the bounty of organisms — everything from people to snails — that live nearby.

Every once in a while, the area experiences a period of excessive rain — a deluge, if you will. "When that happens," as Victor explains, "water fills the once-dry river channels and rushes into the lagoons sometimes breaking the sand barriers." That, in turn, causes the freshwater to mix with the saltwater to create a brackish bouillabaisse characteristic of marshlands.

Because the lagoons periodically cross the "thin green line" between ecosystems, the lagoons' biodiversity is more abundant than the biodiversity in either the terrestrial or marine ecosystems that surround them. Ecologists refer to the dynamics that make this "eco-cornucopia" possible the "principle of edges."

"The lagoons' ecosystems have existed for thousands of years," says Victor, "showing great resilience in the face of nature's powerful and unpredictable forces." In fact, two different kinds of lagoons have

evolved over time: Depending on the characteristics of the soil, some of Oman's lagoons are covered with mangroves and some are not, a factor that only adds to the area's environmental richness."

But as Victor observes, "While the lagoons' ever-evolving ecosystems are driven by powerful natural forces, they are also very fragile and highly vulnerable to human disturbances." And that is exactly what has happened in Oman, where population growth, migration, tourism and infrastructure development have degraded many of the nation's lagoons over the two past two decades.

"When the World Conservation Union (ICUN) published a report on the ecological state of Oman's lagoons in 1986, it noted that some 56 lagoons were currently in good health but nevertheless at long-term risk. Seven years later, in 1993, Oman's Ministry of Environment commissioned another study that came to this conclusion: just 13 lagoons remained healthy enough to be protected. The rest had been degraded beyond the hope of being restored."

External pressures have taken their toll. For example, beachfront construction has disrupted the lagoons' ecology. Meanwhile, population growth, migration, recreational development and tourism have placed additional stress on these fragile ecosystems.

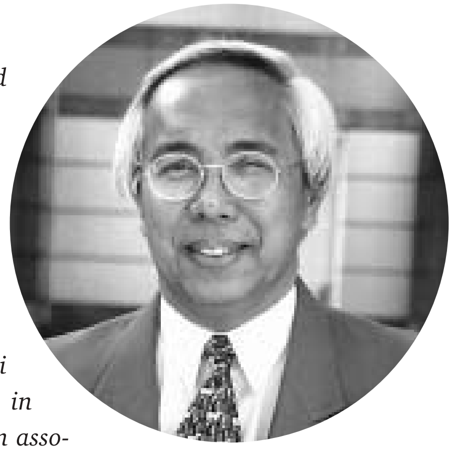
"The experience in Oman," Victor notes, "illustrates an important lesson concerning the future of global biodiversity and the management of habitats that are responsible for nurturing that diversity. We must forge policies and programmes that protect these environments before the scientific research is complete. If we fail to act until there is complete scientific certainty, then we face the prospects of doing additional and sometimes irreversible damage to the ecosystem."

Despite the delay, Victor is delighted to report that Oman's Ministry of Environment has recently enacted an action plan for the 13 remaining lagoons that is based largely on the findings and recommendations made by his research team during the early 1990s.

"It will take time to implement the plan but the government has the financial resources and the political will to take the steps that are necessary to ensure success. What we still lack is the local expertise that is necessary for progress to take place over the long haul. After all, the lagoons ultimately belong to the people who live nearby and it is their knowledge and commitment that will determine whether the policies put in place can be sustained for as long as the lagoons exist."

That is another lesson that Victor and other participants hope to discuss during the next two years as they share their experiences in the conservation and wise use of biodiversity in arid and semi-arid ecosystems from around the world. ■

For more information about Oman's environmental strategies for preserving the nation's lagoons, please contact ➝ ***Reginald Victor**, Director, Centre for Environment and Research, Department of Biology, College of Science, Sultan Qaboos University, PO Box 36, PC 123, Sultanate of Oman; fax: + 968 515433; e-mail: victor@omantel.net.om, victor@gto.net.om.*



Malaysian-born A. H. Zakri (TWAS Fellow 1997) has enjoyed a distinguished career in science as a researcher, administrator and diplomat. Educated at the College of Agriculture, Malaya, where he received a diploma in 1969, Zakri continued his education in the United States, earning a bachelor's degree in crop science from Louisiana State University in 1972 and master's (1974) and doctorate (1976) degrees in genetics and plant breeding from Michigan State University. With his advanced degrees in hand, Zakri returned home to lecture at Universiti Kebangsaan Malaysia (UKM, the National University of Malaysia) in the late 1970s, quickly moving up the academic ranks to become an associate professor in 1980 and full professor in 1986. Genetics and plant breeding of indigenous rice and soybean varieties served as his major research fields. Zakri also displayed admirable administrative talents — in launching the Department of Genetics at UKM (1978) and then in serving as deputy dean of the Faculty of Life Sciences (1983 to 1987) and dean (1987 to 1992). In 1992 he was promoted to deputy vice chancellor at UKM, a post he held until 2000.

SPEAKING WITH ZAKRI

The government took notice of Zakri's on-campus success and in 1990 named him one of Malaysia's official negotiators at the Convention of Biological Diversity, an agreement ultimately discussed at the Earth Summit in Rio de Janeiro in 1992 and signed by 150 nations. Since then he has served as a member of the Malaysian delegation to the convention and, in 1997, he was elected chairperson of the convention's Subsidiary Body on Science, Technology and Technological Advice. Continuing his ascent in the international science policy arena, he recently was appointed co-chair of the Millennium Ecosystem Assessment, sharing responsibilities with Robert Watson of the World Bank. The assessment, which is a major international undertaking sponsored by a host of United Nations (UN)-related organizations, is designed to assess the state of the world's ecosystems and provide benchmarks similar to those created for global climate change by the Intergovernmental Panel on Climate Change (IPCC).

In January 2001, Zakri assumed yet another major challenge as Director of the United Nations University (UNU) Institute for Advanced Studies (IAS) in Tokyo. Launched in 1996, IAS conducts research and post-graduate training, focusing on natural and societal systems. Its activities are conducted both in-house and through a global network of academic institutions and international organizations. Zakri hopes to increase the visibility and, more importantly, IAS's impact on the UN's decision-making process in areas of critical importance to the global community, including issues related to the environment and sustainable economic growth.

The editor of the TWAS Newsletter recently sat down with Zakri to discuss a wide range of topics *related to his multi-faceted responsibilities. Discussions focused on the institutions currently occupying much of his thought and energy: the Convention on Biodiversity; the Millennium Ecosystem Assessment; and the Institute for Advanced Studies. Excerpts follow.*

Over the past decade you have devoted a great of effort to strategies for implementing the Convention on Biological Diversity. Why do you think this convention is so critical?
I have a personal and professional interest in biodiversity dating back to my university days when I studied plant genetics and plant breeding. At the time, I didn't think that any other discipline played a more critical role in food security and other prominent global resource issues. I still believe that today. Fortunately, I am not alone in this assessment. Some 180 nations signed and ratified the Convention on Biological Diversity and most have continued to remain active in follow-up negotiations focusing on devising action plans for the conservation and sustainable use of nature's life-giving biological diversity that also serves a critical role as a global indicator of environmental health. Discussions on biodiversity have concentrated on three major issues: conservation, sustainable use and the equitable sharing of benefits. When the debate on biodiversity emerged about a decade or so ago, conservation was the prime focus for scientists, the media and public officials. In my opinion, as well as the opinion of many other scientists from the South, this concern revealed a developed world bias towards the issue. That's not to say that conservation is insignificant. But from the viewpoint of the developing world, where societies often face critical problems concerning nutrition, health and housing on a daily basis and where much of the economy is resource-based, concerns for conservation must be balanced with concerns for sustainable use. It's patently unfair and unethical to ask people in developing countries to forego immediate basic needs for the benefit of future generations, especially when their societies place much less stress on ecosystems and resources than societies in the North. One of the positive outcomes of the negotiations that have taken place since the signing of the convention is that the voices and concerns of developing countries have been heard and largely embraced by their counterparts in the developed world. As a result, a consensus has been reached on two key factors: that the world's biodiversity should not just be conserved but should be wisely utilized by people throughout the world, and that citizens in the developing world should not be asked to adopt resource management practices that can undermine their efforts to improve their economic and social well-being. Negotiators now agree, for example, that some timber in certain areas rich in biodiversity may have to be cut to increase agricultural production or to provide lumber for overcoming critical housing shortages. All of this means that the debate over "conservation" and "use" has become a tired debate that no longer carries much resonance in the meeting rooms of convention members. The critical issue at this point is how to transform the ambitious balanced objectives of the convention into concrete blueprints and programmes for action.

How do you define sustainability, a word that has become the cornerstone of much of the discussions concerning biodiversity and many other global environmental issues?
Sustainable development is defined as "development that meets the needs of the present generation without comprising the ability of future generations to meet their own needs." Simply put, sustainability means that individuals and societies may have the right to exploit a natural

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resource but they have no right to deplete it. The idea is simple to understand at a conceptual level; the difficulty lies in the implementation of policies and programmes that are designed to achieve the goals inherent in the concept. For example, at what point does the clearing of forests (to increase agricultural output or provide timber for housing) become unsustainable, undermining the potential well-being of future generations? As you might imagine, such questions are easy to pose at an abstract level but difficult to realize in the real world. Answers lie in the research of scientists and the work of foresters, soil experts and land planners. No solution, however, is possible without adequate funding. That is why it is critical to persuade national governments, multilateral institutions and international aid organizations to invest in such efforts. Raising public awareness about what is at stake and how difficult it is to assess either the scope of the problem or the appropriate dimensions of the response have become major concerns of the countries that are parties to the Convention on Biological Diversity. The guiding principles for the conservation preservation and sustainable use of biodiversity are now in place but it is still uncertain if these "balanced" principles will ever be put into practice on a global scale. That is the true test of the convention's importance and that is where the convention's value will ultimately be determined. There are some encouraging signs — for example, the effective resource management plan that has been enacted in a transboundary park in southeast Asia, Lanjak-Entimau, through a bilateral agreement between Indonesia and Malaysia. The plan, administered by the International Tropical Timber Organization headquartered in Yokohama, Japan, is preserving hundreds of thousands of hectares of pristine forest land without fraying the economic and social fabric of the people who live there. The positive implications for biodiversity in the region are enormous and the initiative deserves all the praise it has received. The question is whether these encouraging results can be replicated in other places on a regular basis. Thus far the best we can say is 'perhaps.'

Let's move to another major initiative that you are involved in, the Millennium Ecosystem Assessment, for which you now serve as co-chair with Robert Watson of the World Bank. Could you explain the importance of this project and what has been achieved to date?

The project, first discussed about 2 years ago, is designed to look at the environment holistically and to focus on the ecosystem as a rallying point to promote environmental restoration and use for nurturing long-term economic and social well-being. Policy makers often have a wealth of information to draw on for assessing the state of the economy, public health and education. But the same level of information rarely exists for assessing the state of an ecosystem. In fact, ecosystem assessments usually suffer from two shortcomings. First, studies are sectoral in their orientation, usually focusing on a specific aspect of the ecosystem — for example, forests, fisheries or agriculture. Second, studies often fail to present concrete policy options. As a result, they do not discuss ecosystem trends in ways that allow policy makers to appreciate the tradeoffs involved in implementing a particular policy or program. The assessment will seek to address both of these shortcomings by devising a general analytical framework to examine ecosystems from a holistic point of view. We intend first to link all of the intricate aspects of an ecosystem and then to explore how different resource management practices have impacted — and will continue to impact — the system in the future. The assessment, officially launched this spring, has received backing from several international organizations — including the United Nations Environment Programme (UNEP), the United Nations Development Program (UNDP), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the World

Bank and the UN Foundation. The proposed 4-year initiative carries a significant price tag of about US$21 million. So far, funding organizations, led by the UNEP's Global Environmental Facility, have pledged more than half of the required amount. However important the participation of large international organizations and the value of large financial contributions may be, they are not nearly as important as the involvement of diverse stakeholders. That is because eco-assessments must take place on a variety of scales ranging from local to global systems. Assessments, moreover, must be based on data drawn from both basic and social sciences. Such a comprehensive approach can only succeed if a wide spectrum of the global community cooperates in collecting information, assessing policy options and devising science-based strategies for improved resource management. There is no doubt that the assessment is a complex initiative that will operate along the gray uncertain borders not just of scientific disciplines but of research and policy. Despite the difficulties inherent in what we are trying to do, I am convinced that the initiative could carry many both for our global environment and global economy. In fact, the assessment could give real and lasting meaning to the term sustainable development. That is why, in my opinion, the effort is well worth the financial investment, as well as the time and commitment, of the parties involved.

In January 2001, you became Director of the United Nations University's (UNU) Institute for Advanced Studies (IAS). Could you briefly describe IAS's mandate and the directions you hope to take the institute in?

The Institute of Advanced Studies (IAS) conducts research on issues that reside at the intersection of societal and natural systems. Initially, the institute focused its efforts on the challenges of "eco-restructuring for sustainable development" — that is, the transformation, or shifting, of technological, economic and societal systems and practices towards a path of greater sustainability. IAS pursued four general programmatic subthemes: urbanization; economic planning; multilateralism; and science, technology and society. At IAS, advanced studies is a term that carries several implications. In a general context, it refers to a multidisciplinary approach to research problems. IAS engages experts from such traditional disciplines as economics, law, biology, political science, physics and chemistry asking them to pool their knowledge and experience to address key challenges to sustainable development. IAS also uses advanced research methodologies to challenge orthodox thinking and uncover creative solutions to our most pressing global problems. Finally, IAS's advanced research framework seeks to identify strategic areas of research of importance to decision makers, particularly in developing countries. On the hand, the institute must focus on research themes that are new and creative and help to set research agendas elsewhere. On the other hand, IAS must continue to build its own unique knowledge base and not risk being perceived as merely latching on to research trends or fashions. Our objective is to create an institute that is well regarded for its expertise in specific policy areas, yet is renowned for its innovation and forward-looking attitude. IAS's research programme must be carefully defined and aimed at addressing the needs of specific users and audiences. These needs, of course, may be vast. Faced with such a situation the IAS must prioritize the scope of

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its research. Because IAS is mainly concerned with the interaction between societal and natural systems, sustainable development is a logical research focus. Yet sustainable development is a principles so broad in scope that creating a focused research agenda remains challenging. That is one of the main reasons why few practical strategies have been formulated for achieving sustainability in a meaningful way. IAS can play an important role in this regard by conducting research and offering solutions on specific challenges and issues related to sustainable development. IAS, for example, can concentrate its research efforts on the use and impact of new information technologies or it can examine in depth major trends related to urbanization — all from a unique, integrated framework that decision makers may find both refreshing and revealing. IAS pursues its responsibilities with a core faculty of 16 people plus a dozen or so visiting and adjunct professors. We extend our reach through our research fellowship programme and our partnerships with other institutions such as UNESCO and TWAS. Although concrete new proposals will only take shape after I have had an opportunity to become better acquainted with the institute, there are several broad areas where I will likely concentrate my efforts. First, I plan to strengthen IAS's ties with other organizations. For example, I believe IAS could work more closely with TWAS to improve IAS's fellowship programme for advanced Ph.D. students and post docs. TWAS, for instance, could help identify potential candidates and cooperate in their selection. Second, while the IAS has accomplished a great deal, it remains relatively unknown even among those involved in scientific research and policy. I would like to raise the organization's profile both among scientists and the public. One of the first steps I plan to take to advance this goal is to create the U Thant Distinguished Lecture series in which we will invite internationally renowned scientists, thinkers and world leaders to talk about issues of importance to the global community. We anticipate that these talks will receive a great deal of press coverage, both worldwide and in Japan. That brings me to the third issue that I hope to concentrate on during my tenure at IAS: I would very much like to strengthen IAS's role as a bridge between scientists and science administrators in Japan and those in other nations. I think such links would prove beneficial not only to our host country but to scientists and science administrators throughout world.

How do your varied responsibilities as a scientist, educator, administrator and diplomat fit together, particularly in terms of the global scientific agenda?

All of my modest contributions to the world of science have been driven by a desire to create better understanding among people in ways that help to forge links between disciplines, organizations, environmental and economic sectors, nations and international organizations. Ultimately, I hope that these contributions help make the world a better place in which to live. My career has moved forward not on the weight of my own shoulders but with the assistance of others. Whatever I have accomplished through my work on the Convention on Biological Diversity, the Millennium Ecosystem Assessment and now at the Institute for Advanced Studies is testimony to this guiding principle: the ability to cross boundaries — whether in disciplines or diplomacy — always carries the potential for significant progress. And equally important, the ability to cross these boundaries depends on partnerships and networks that transcend the abilities of a single individual. In the end, the methods by which I have tried to reach my goals have proven just as important as the particulars of what I am trying to accomplish. It is the element of constant exchange and change that has made these efforts both endlessly challenging and, I hope, valuable.

THE ACADEMY'S NEWEST MEMBERS

IN 2000, 44 FELLOWS AND 5 ASSOCIATE FELLOWS (AF) WERE ELECTED MEMBERS OF THE THIRD WORLD ACADEMY OF SCIENCES. BELOW ARE THE NAMES OF TWAS'S NEWEST MEMBERS.

AGRICULTURAL SCIENCES

- In-Kyu **Han**, Korea Rep.
- Abdul Mujeeb **Kazi**, Pakistan
- Dolores A. **Ramirez**, Philippines
- Qifa **Zhang**, China

BIOLOGY

- D. **Bajracharya**, Nepal
- Raghavendra **Gadagkar**, India
- Gabriel **Guarneros P.**, Mexico
- Pablo **Rudomin Z.**, Mexico
- Francisco M. **Salzano**, Brazil

BIOCHEMISTRY AND BIOPHYSICS

- Lila **Castellanos Serra**, Cuba
- Juan José **Cazzulo**, Argentina
- Chhitar Mal **Gupta**, India
- Xin-Yuan **Liu**, China

CHEMISTRY

- Hernan **Chaimovich**, Brazil
- Habib **Firouzabadi**, Iran I.R.
- Jai Pal **Mittal**, India
- T. **Ramasami**, India
- Fosong **Wang**, China

ENGINEERING SCIENCES AND TECHNOLOGIES

- Dwijesh K. **Dutta Majumder**, India
- Wook Hyun **Kwon**, Korea Rep.
- Herbert A. **Simon**, USA (AF)
- Swaminathan **Sivaram**, India
- Anwar **Ul Haq**, Pakistan
- Luguang **Yan**, China
- Chaochen **Zhou**, China

EARTH SCIENCES

- Zhisheng **An**, China
- Yong **Chen**, China
- Vinod K. **Gaur**, India
- S. **Krishnaswami**, India

MATHEMATICS

- Louis H.Y. **Chen**, Singapore
- Djairo G. **de Figueiredo**, Brazil
- Phillip A. **Griffiths**, USA (AF)
- Viêt Trung **Ngô**, Vietnam

MEDICAL SCIENCES

- Riad A.L. **Bayoumi**, Sudan
- Fayçal **Hentati**, Tunisia
- Felix I.D. **Konotey-Ahulu**, Ghana
- Asha **Mathur**, India
- Souleymane **Mboup**, Senegal
- Charles O.N. **Wambebe**, Nigeria

PHYSICS AND ASTRONOMY

- Farhad **Ardalan**, Iran I.R.
- Gallieno **Denardo**, Italy (AF)
- Hai-fu **Fan**, China
- Giuseppe **Furlan**, Italy (AF)
- Reza **Mansouri**, Iran I.R.
- Jan S. **Nilsson**, Sweden (AF)
- Herch M. **Nussenzveig**, Brazil
- Luis F. **Rodriguez**, Mexico
- B. Sriram **Shastry**, India
- Zhao-Bin **Su**, China

The institutional affiliation and a description of the scientific achievements of each new member may found on the TWAS website at ***www.twas.org***

MEETING IN INDIA

HUNDREDS OF RESEARCHERS AND OFFICIALS, LARGELY FROM THE DEVELOPING WORLD, ARE EXPECTED TO ATTEND THE WEEK-LONG EVENT IN NEW DELHI, MARKING ONE OF THE LARGEST GATHERINGS OF SCIENTISTS FROM THE SOUTH.

TWNSO

The Third World Academy of Sciences' (TWAS) 8th General Conference and the Third World Network of Scientific Organizations' (TWNSO) 7th General Meeting, which are expected to attract more than 400 scientists and public officials from around the world, will be held in New Delhi, India, from 27-31 October 2001. The Indian National Science Academy (INSA) will host the events in collaboration with the government of India and the nation's leading scientific and technical organizations, including the Department of Science and Technology. Murli Manohar Joshi, Minister of Science and Technology, has been asked to serve as the "patron" of the national organizing committee, which includes 30 of India's most distinguished scientists.

Among the special sessions scheduled for the paired events are a symposium on science in India that will feature presentations by India's foremost scientists and policy makers; a panel discussion on science and technology policy and management in the developing world highlighted by observations from ministers representing eight countries in the South; and a symposium on the problems and challenges facing scientific institutions throughout the developing world with special attention to the growing "capacity gap" between "more developed" and "less developed" developing countries.

"Like the general conferences and general meetings held previously in China, Venezuela, Kuwait, Nigeria, Brazil, Senegal and Iran," notes C.N.R. Rao, president of TWAS and Linus Pauling research professor and honorary president of the Jawaharlal Nehru Centre for Advanced Scientific Research, "the conference is designed to achieve two goals: to examine the present and future status of science in the developing world and to promote South-South and South-North cooperation among scientific research institutions and ministries."

"India," Rao adds, "is delighted to host the event. The scientific community in our nation has enjoyed a long and enduring relationship with the Academy dating back to TWAS's inception nearly two decades ago. Currently, 103 of TWAS's 588 members are from India and an additional 11 Indian scientists working in the North are TWAS associate members."

"In Delhi," says Goverdhan Mehta (TWAS Fellow 1993), director of the Indian Institute of Science and president of the Indian National Science Academy,

who is serving as the chairperson of the organizing committee, "we will have an opportunity to explore the rapid advances in scientific know-how and applications that have taken place in India over the past decade. These advances have made the nation a leader in scientific capacity among countries in the developing world and, in some instances (for example, computer software development and space physics), among the leaders in the world at large."

In addition to the broad discussions on scientific research and development, the conference and meeting will feature lectures by TWAS and TWNSO annual award winners in the basic and applied sciences, TWAS Medal Lectures, and the Abdus Salam Medal Lecture. TWAS and TWNSO business meetings, attended by officers from both organizations, will mark the first two days of the event. ■

Additional information and the programme of the TWAS 8th General Conference and TWNSO 7th General Meeting may be found at
www.twas.org

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TWAS

NEW CHAPTER NEWSLETTER

• The TWAS Beijing Office has issued its first newsletter. The inaugural edition featured reports on the Chinese TWAS Fellows meeting in Beijing; the Chinese Academy of Sciences/TWAS joint Ph.D. and post-doctorate programme; the Chinese Academy of Sciences, TWAS and World Meteorological forum on climate modeling and prediction; and the Chinese delegation attending the recent TWAS 12th General Meeting in Tehran. For more information about the newsletter, phone: +86 106859 7246; fax: +86 10 6851 1095; or e-mail: sqfu@cashq.ac.cn.

DESERT GIFTS

• Recently published research by TWAS Fellow (1985) **Farouk El-Baz**, professor of remote sensing and director of the Center of

Remote Sensing, Boston University (USA) and adjunct professor, Department of Geology, Ain Shams University (Egypt), suggests that the pyramids and sphinx were inspired by natural landforms that abound in Egypt's western desert. Knowledge of these landforms arrived with the desert people who moved to the Nile Valley on the heels of dramatic climate changes some 5000 years ago. Such changes sparked drought conditions among lands that had once enjoyed a much more humid climate. El Baz's findings were published in the March-April 2001 edition of *Archeology*. In the article, El-Baz contends that the merger of two civilizations — Nile farmers and desert nomads — nurtured the flowering of ancient Egyptian civilization and made possible the construction of the great monuments that endure today. For a detailed account of El-Baz's research and analysis, see *Archeology* 54 (March-April 2001).

TWAS/IFS MOU

• TWAS and the International Foundation for Science (IFS) have signed a memorandum of understanding (MOU) that seeks to strengthen cooperation between the two organizations in efforts to advance the development of science and technology in the developing world. The MOU was signed in early March during a visit by newly appointed IFS Director Thomas Rosswall and IFS Deputy Director Jacques Gaillard to the TWAS secretariat. Among other items, the MOA calls on the two organizations to consult and cooperate in the development of activities of common interest and to help disseminate information about each other's programmes. "The memorandum," Rosswall notes, "provides a general framework upon which we can build more specific programmes of mutual interest. TWAS and IFS have a long history of cooperation and we look forward to even closer ties in the future."

GADGIL HONOURED

• TWAS Fellow (1991) **Madhav Gadgil**, professor of ecological science at the India Institute of Science and honorary professor of the Jawaharlal Nehru Centre for Advanced Scientific Research, has been made an honorary member of the Ecological Society of America. The award is given annually to a distinguished scientist who has made exceptional contributions to

Madhav Gadgil

the field of ecology and whose principal residence and research takes place outside of the United States, Canada and Mexico. Gadgil received a bachelor of science degree in zoology from Poona University, India, and advanced degrees in zoology (a master's) and biology (a doctorate) from Harvard University, USA. He served as a scholar in the Pew Program in Conservation and Environment and was a recipient of the Shanti Swarup Bhatnagar Award for Biological Sciences. He is also a fellow of the Indian National Science Academy, a foreign associate of the U.S. National Academy of Sciences, and an honorary member of the British Ecological Society. In 1998, Gadgil was appointed chair of the Scientific and Technical Panel (STAP) of the Global Environment Fund (GEF). His main research areas include population biology, conservation biology, human ecology and ecological history. He has been active in participatory eco-development research and has written extensively about ecological issues for the public in both print and broadcast media.

Adeyinka Gladys Falusi

L'ORÉAL PRIZE WINNERS

• Two TWOWS (Third World Organization for Women in Science) members have been selected as winners of the 2001 L'ORÉAL Awards for Women in Science with the support of UNESCO. **Adeyinka Gladys Falusi**, professor of biomedicine at the University of Ibadan, Nigeria, and **Anne McLaren**, principal research associate at the Wellcome/CRC Institute in the United Kingdom, were among the five women chosen for this year's award. The awards, worth US$20,000 each, recognize the fundamental contributions of women to scientific research, particularly in the life sciences. Falusi was honoured for her research on molecular genetics related to such hereditary blood diseases as sickle cell anemia and alpha-thalassemia. Her findings have proven instrumental in opening the way for the prevention of these diseases through prenatal diagnosis. McLaren was honoured for her work on embryo development, especially in relationship to in vitro fertilization and prenatal diagnosis. McLaren has recently extended her research to include studies of germ and stem cells. The awards were officially presented by L'ORÉAL's Chairperson and Chief Executive Officer, Lindsay Owen-Jones and UNESCO's Director General, Koichiro Matsuura, at a ceremony held in Paris this March. For additional information about these award, see www.forwomeninscience.com.

ALLENDE, PALIS ELECTED

• **Jorge E. Allende (TWAS fellow** 1985), director of the Institute of Biomedical Sciences at the University of Chile in Santiago, and **Jacob Palis** (TWAS fellow 1991), professor at the Institute of Pure and Applied Mathematics in Rio de Janeiro, Brazil, have been elected foreign associates of the U.S. National Academy. They were among 15 foreign associates chosen

Jacob Palis

for their distinguished contributions to science; 72 new members from the United States were also selected. The announcement was made at the Academy's 138th annual meeting held in May. Election into the U.S. National Academy is considered among the highest honours that can be bestowed on a scientist or engineer. Academy membership now numbers 1874; foreign associates 325. A full directory of Academy members can be found online at national-academies.org/nas.

BRAZILIAN FUNDING

• Through the auspices of UNESCO, the Brazilian Ministry of Science and Technology has made a grant to TWAS of approximately US$100,000. Half of the funding will be used to promote scientific cooperation between Brazil and the Portuguese-speaking countries in Africa, especially in the fields of meteorology and space science. The other half of the funding will be used to expand access to existing TWAS/TWNSO research and training activities, including the organizations' fellowship, research and donations programmes. For additional information about the project, please contact José I. Vargas, Brazilian Ambassador at UNESCO, 1, rue de Miollis, 75.015 Paris, France, phone: +33 1 4568 2838, fax: +33 1 4825 2840, e-mail: c.fernandes@unesco.org.

CORRECTION

• In the article "Meeting in Iran" (*TWAS Newsletter* Vol. 12, No. 4), the reference on page 12 to global climate temperatures should read: "global temperatures will rise between 1.0 and 3.5 degrees centigrade by the end of the century," not 10 and 3.5 degrees.

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 585 members from 75 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-online.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