TWAS Newsletter

The Newsletter of the Third World Academy of Sciences

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EDITOR'S NOTE

Change in Face

The TWAS Newsletter takes on a new look with this issue. We hope that our change in appearance isn't deceiving because in many ways the "new" newsletter is much like the old one. Our primary goal remains to keep you informed about recent events concerning TWAS and to provide you with information about the accomplishments of your fellow Academy members. We also hope to open our pages to issues of importance to the scientific community, particularly in the South. This edition, for example, includes a bylined article by TWAS Associate Fellow, Elizabeth Mann Borgese, that discusses the current state of the world's oceans in the context of the United Nations designated "Year of the Ocean," which is taking place this year. We also have included an interview with John Ohiorhenuan, the newly appointed head of the United Nation Development Programme (UNDP) Special Unit for Technical Cooperation Among Developing Countries (SU/TCDC). Ohiorhenuan talks about the ties between science, technology and development in Africa.

The TWAS Newsletter is designed to serve its members. For this reason, we welcome your comments and suggestions. In fact, we consider the Newsletter's "new look" just a "temporary makeover." If there are changes you would like us to make, by all means drop us a line. If activities are taking place within your institution that you think we should highlight, please let us know. If you have recently been honoured by a new appointment or award, don't hesitate to contact us. And if you have ideas for feature articles–particularly articles that you would be willing to write—we're here to help you air your viewpoints and opinions. We're easy to reach by phone, fax or e-mail. All the numbers are all listed here on the masthead. We look forward to hearing from you.

Daniel Schaffer
TWAS Editor

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TWAS NEWSLETTER
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COMMENTARY

STRATEGIC PLAN

Earlier this year, following lengthy discussions at our 6th General Conference in Rio last September, the Academy published its second strategic plan, which it hopes will guide its actions between now and the end of the century.

The first strategic plan focused on internal matters: TWAS's membership, awards programmes and capacity-building initiatives. To the credit of the Academy's members and staff, we reached many of our goals: our membership increased to nearly 450; our programmes, particularly our research grants programme, continued to grow in both size and reputation (by 1997, TWAS had provided more than 1000 research grants to scientists in more than 70 countries); and our awards programme has reached a stage that makes it one of the most coveted among distinguished scientists in the South.

TWAS's ability to succeed depends first and foremost on the internal strength of its organization: the accomplishments of its membership, the quality and impact of its research and capacity-building initiatives, and the reputation of its awards programme. That's why our first strategic plan focused on such issues, and that's why our second strategic plan will continue to do so. It should come as no surprise that two major provisions of our new plan are to increase the TWAS endowment fund, which now stands at nearly $3.5 million and to expand our activities both among women scientists throughout the South and researchers—male and female—working in the poorest nations of the developing world.

But our second strategic plan also looks beyond the immediate concerns of TWAS by calling on the Academy to (1) promote sustainable scientific development throughout the developing world and (2) strengthen the Academy's ties with universities, research institutes and scientific academies in both the South and North.

To this end, we hope to forge even stronger ties with science and technology ministries across the South largely through the work of TWAS's affiliated organization, the Third World Network of Scientific Organization (TWNSO). As noted in the new strategic plan, TWAS plans to "pay particular attention to the growing complexity of the problems confronting environmentally and socially sustainable development in Third World countries." It will seek to accomplish this goal "by enhancing the capacities of scientific communities and institutions in these countries to produce and apply solutions to specific real-life problems."

At the same time that we were putting the finishing touches on our strategic plan, the Department of Research Cooperation (SAREC) of the Swedish International Development Cooperation Agency (SIDA) announced that it has awarded the Third World Organization for Women in Science (TWOWS), an affiliate of TWAS, a generous grant to initiate a postgraduate training programme for female students in Africa. Meanwhile, TWOWS's 2nd General Assembly and Conference will take place next February in Cape Town, South Africa, thanks to a generous grant from the Foundation for Research Development (FRD) of South Africa.

Both our second strategic plan and our new grant initiatives seek to acknowledge the new challenges we face in terms of our goals and membership. At the same time, the plan seeks to provide a clear road map to help us successfully navigate this new terrain. We will seek to address these concerns while remaining true to our original mandate: "to recognize and encourage scientific excellence in developing countries." In fact, our plans and measures have been specifically designed to help us fulfil this goal.

All TWAS members should have received a copy of our second strategic plan in the mail a short time ago. I urge you to take the time to carefully read the text and I look forward to your comments.

Mohamed H.A. Hassan
TWAS Executive Director

WE CAN DO IT AGAIN

UNDP/TWNSO project on science and technology in developing world reaches second stage. Case studies are chosen. Book will follow.

SCIENCE AND TECHNOLOGY (S&T) INITIATIVES ARE SIGNIFICANT NOT ONLY FOR THE COUNTRIES WHERE THEY ARE LAUNCHED BUT FOR THE VALUABLE LESSON THEY TEACH OTHER NATIONS.

That's why it's important for scientists and technologists throughout the South to share their experiences, which is precisely the goal of a joint project of the Third World Network of Scientific Organizations (TWNSO) and the United Nations Development Programme's (UNDP) Special Unit for Technical Cooperation Among Developing Countries (SU/TCDC).

The official title of the TWNSO-SU/TCDC project is "Sharing Innovative Experiences among the Developing Countries." R.A. Mashelkar, chairperson of the project's steering committee and director general of India's Council of Scientific and Industrial Research (CSIR), talks about the initiative this way: "The experiences we plan to showcase will illustrate that when it comes to science and technology in the South, 'we can do it.'"

On 21-23 April, the project's steering committee met in Trieste, Italy, to select the case studies that will be included in a monograph to be published this year in conjunction with the 20th anniversary of the Buenos Aires Plan of Action. The plan, which was a UN initiative, has helped chart the course for wide-ranging cooperative efforts among governmental and nongovernmental agencies throughout the South.

In addition to Mashelkar, committee members attending the meeting included Ruy de Araujo Caldas, director of special projects for the National Council for Scientific and Technological Development, Brasilia, Brazil; A.A. Hebeish, past president of the Academy of Scientific Research and Technology, Cairo, Egypt; and Sang Soo Lee, professor emeritus in physics at the Advanced Institute of Science and Technology, Taeion, South Korea. They were joined by John Ohiorhenuan, the newly appointed director of the SU/TCDC and Atsede Worede Kal, information services officer for the SU/TCDC (see interview with Ohiorhenuan, page 12). Their offices are located at the UN headquarters, New York City. Mohamed H.A. Hassan, TWNSO secretary general and executive director of the Third World Academy of Sciences, was also in attendance.

Specifically, the committee examined some 130 entries that had been received from S&T research centres throughout the South. The entries, from more than 30 countries, came in response to a letter that the committee had sent to the centres last summer asking them to describe their innovative experiences.

At the April meeting, the committee chose 30 entries for inclusion in the book. At the same time, it selected an additional 40 entries that will form part of an electronic data base, developed by TCDC, outlining valuable S&T experiences in the developing world. This "electronic catalogue," to be shared with scientific and technology centres throughout the South and North, will be periodically updated and expanded.

Among the entries chosen for inclusion in the book are:

- **Department of Physics at the University of Chile**, which has developed a cost-effective method for wastewater treatment. The two-step process, which first sends the wastewater through a biofilter to remove microorganisms and then eliminates the remaining pathogens through ultraviolet radiation, can be used at a variety of different scales. Such flexibility should prove extremely useful in efforts to improve water quality, especially in remote rural areas that lack the resources and expertise to take advantage of more complex and expensive wastewater treatment systems. The method, for exam-

ple, consumes far less land than sedimentation ponds and is much less expensive than strategies that rely on "oxygenated" sludge.

• **Federal Institute of Industrial Research** in Nigeria, which developed a mechanized technique for processing the tropical plant cassava that is used for the production of bread and other essential foods throughout the developing world. The process, which is driven by a motorized grater, has replaced the manual methods of production that were prevalent for centuries. In addition, electric-powered cylindrical dryers are now used instead of energy-hungry frying pots. This eliminates the risk posed by toxic fumes. The result is that cassava flour, a diet staple in Nigeria and many other tropical countries, is produced more efficiently while posing fewer health risks to workers. The final product, moreover, has a shelf-life of 18 months. This allows distribution to take place over a wide geographical area.

The developing world is making solid progress in its efforts to advance science and technology.

• **International Centre for Diarrhoeal Disease Research** in Bangladesh, which has developed a simple and affordable rehydration treatment for cholera which afflicts millions of people throughout the developing world. Today, the treatment is the driving force behind efforts to combat this potentially deadly disease. Public health officials estimate that it saves more than one million lives annually.

• **Marmara Research Centre** in Turkey, which has created a system of newspaper archiving that takes advantage of state-of-the-art information technologies, including image processing, optical character recognition, hypertext and the internet. The user friendly system aids researchers, lawyers, journalists and everyday citizens interested in acquiring information quickly and efficiently. Before the creation of this system, newspapers were archived in huge paper volumes that were difficult, if not impossible, to access. The archives, moreover, were subject to age rot and water damage. This joint public/private-sector initiative has not only served the needs of its clients but has broadened the technical skills of the researchers who were assigned the task of developing and managing it.

• **National Institute of Space Research** in Brazil, which has developed a photovoltaic module—six solar cells attached to a solar panel—that were placed onboard Brazil's first satellite launched in February 1993. Ground stations, located in Brazil, have received temperature and voltage data from the cells. The goal was to measure the effects of radiation over extended periods. After four years, the experiment also showed that the cells retained efficiency levels comparable to the levels that had been measured at the time the satellite was lifted into orbit. The outcome has heightened both scientific and public awareness of the potential for the development of solar and renewable energy.

"Each of these case studies—and the others that will be included in the TCDC book and electronic data base—will illustrate the ways in which appropriate scientific research and technological advances are being put to work to improve the quality of life throughout the developing world," notes Mashelkar. "The ultimate goal of the project is to help people throughout the South—from public officials to scientific researchers to everyday people—learn from one another."

Discussions of institutional and community-based projects will be supplemented by several case studies examining national science and technology initiatives that have required substantial resources and long-term commitments on the part of the government.

Such initiatives include Brazil's gasohol programme, which has gained international recognition as one of the world's most successful alternative fuel programmes; the growth of South Korea's automobile industry, which has been transformed from a struggling domestic industry to a global player in less than two decades; and the so-called "white revolution" in India, which through a mixture of state-of-the-art science, business management and transportation logistics, has transformed the globe's second most populous nation into the world's number-one milk producer.

"These examples of broader national initiatives in science and technology," Mashelkar says, "will show that the developing world, particularly nations like Brazil, China and India, has the capacity to compete on a global level if their governments are willing to make the necessary long-term financial and political investments. They offer hope that other nations can follow in their footsteps."

"The project's case studies and national initiatives," Ohiorhenuan adds, "will reveal how both appropriate and cutting-edge technologies are being used throughout the developing world to improve the economic and social well-being of its people."

"It has become fashionable to talk about economic globalization, but the same forces are at work in the world of science and technology. For this reason, I'm convinced that both the book and electronic data base that we produce will be of use not only to citizens and scientists in the South but to their counterparts in the North as well." ■

YEAR OF THE OCEAN

Our oceans cover more than two-thirds of the Earth's surface. They are so vast that we have assumed they were beyond abuse. Scientists now know otherwise.

THE UNITED NATIONS HAS DESIGNATED 1998 AS THE INTERNATIONAL YEAR OF THE OCEAN. DURING THE PAST THREE DECADES, THE OCEAN HAS EMERGED AS A DRIVING FORCE BEHIND THE GLOBAL ECONOMY. OFF-SHORE OIL AND GAS RESERVES NOW MAKE THE OCEAN A PRIME SOURCE OF ENERGY. SEA-BOTTOM SAND AND GRAVEL PROVIDE IMPORTANT MATERIALS FOR CONSTRUCTION.

Recent investigations into tidal waves, thermophile microbes and methane hydrates have spurred interest among scientists and industrialists concerning future uses of the ocean's unique resources. Most importantly, the fishing industry and aquaculture produce a major portion of the world's food supply. In poor counties, the ocean is the primary source of animal protein.

The bottom line is this: the ocean is a key contributor to global food and energy supplies, trade, transport and tourism. The value of goods and services depending directly or indirectly on the ocean totals between US$7 and US$8 trillion. That figure will undoubtedly climb in the next century.

As global population continues to rise, meeting global demands for water has been more and more problematic. Compounding the problem is the fact that human activities often undermine the quality of existing water supplies. Water has increasingly become a volatile political issue as nations and regions compete for scarce water supplies.

The ocean, which contains 95 percent of all the earth's water, may help address this problem. Assuming continued technological advances and the availability of nonpolluting renewable energy, enough sea water could be desalinated to satisfy the needs of swelling global populations. Today, more than 60 percent of the world's people live within 100 kilometres of the coast. This global trend only serves to brighten the prospects for desalinization.

Beyond the ocean's economic value and its potential to satisfy future world demand for water lies this fact: the ocean is a basic component of our life-support system. Ocean-bound micro-algae produce 70 percent of the oxygen we breathe. Although it is difficult to assign an economic value to the ocean's oxygen output, there is no doubt about the importance of this life-giving service. We could not live without it.

The ocean provides other "eco-services" too. For example, the carbon dioxide exchanged between the ocean and atmosphere is a key factor in determining changes in climate. The ocean serves as a "sink" that helps mitigate the impact of global greenhouse gas emissions. Closer to earth, ocean mangroves often shield coastal residents from the brutal force of hurricanes and tsunamis. One

study recently placed the value of this service at US$21 trillion, nearly two-thirds of the estimated value of the services rendered by the ecosystem as a whole. A vigorous public education campaign has raised public awareness about the value of our rain forests. It is now time for the public to gain the same appreciation for the ocean.

Recent advances in our understanding of the ocean's evolution, based on studies of tectonic theory and continental drift, has created a new vision of how our planet developed. Yet the more we know about the ocean, the more we realize how little we do know. Efforts to combine remote sensing techniques with complex models and onsite explorations are likely to produce additional surprises about the earth's most remote and mysterious environment.

ANCIENT MYTHS

It is astonishing how modern science often confirms our ancient myths. Mythologies across the globe tell how life on earth originated in the ocean; how great floods separated the Americas from other continents and created islands that had not existed previously; how giant worms inhabit the dark, deep ocean floor where water boils; and how the ocean both nourishes and poisons.

In the year of the ocean we should re-examine these myths. We should celebrate the poetry, paintings, music and dance that convey our fascination with the majesty and terror of the ocean. Such endeavours would help clarify the important role the ocean plays in our lives.

Since the very nature of the ocean, where everything flows, is so different from the very nature of the land, where everything is firm, the ocean forces us to think differently. Key concepts related to life on land cannot be transferred to the ocean.

In the twentieth century we have moved the industrial revolution into the ocean. Now we are paying a price for this effort, in terms of environmental degradation, species loss and threats to human health and life. Initiatives that seek to impose land-based economic and political order on the ocean are doomed to fail. Such concepts as "boundaries," "property," "ownership," and "sovereignty" do not work in the ocean—at least in the ways that these concepts work on land. Every critical element of the ocean—fish, wind, currents and pollution—cannot be confined by artificial boundaries.

COMMON HERITAGE

When it comes to the ocean we must act differently. Existing laws and regulations must be dismantled before new ones can be built. That is why the United Nations Convention on the Law of the Sea, which entered into force in 1994, is such a revolutionary document.

It is the first comprehensive global law governing the ocean and its resources. Because this law forces us to think differently about questions of boundaries, property, ownership and sovereignty, it may offer a preview of our world order in the twenty-first century.

After all, we now live in a global village on land as well. Boundaries cannot contain the "information revolution," and "sovereignty," in an age of economic and environmental globalization often is more illusionary than real.

The Law of the Sea is based on an ancient yet novel principle, especially in the Western world: that the ocean, on which all life depends and in which all "boundaries" are blurred, is the common heritage of mankind. That is why we bear common responsibility for its conservation and for equitably sustaining the benefits we derive from it.

Because everything in the ocean interacts with everything else, its environment can be managed and conserved only through cooperation. Indeed cooperation is the key to addressing all issues related to the ocean. Economic development and environmental protection must be reconciled, and abject poverty in the midst of wasteful wealth must be abolished. Otherwise there can be no peaceful cooperation. The new order for the ocean contains a strong ethical component, often ignored by Western scientific and economic "value-free" theories.

The Law of the Sea also aims to enhance economic development

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Photos: Raniero Trevisan

and environmental conservation. In fact, the law is the only existing comprehensive international environmental statute comprising all seas and oceans and covering all kinds of pollution—land-based, ship-borne, sea-bed and atmospheric.

In the twenty-first century we must build institutions to effectively implement the provisions of the Law of the Sea. Blueprints for these efforts were drafted at the Rio Conference on Environment and Development held in 1992. That historic gathering led to conventions on biodiversity and climate change and an action programme embodied in its concluding report, Agenda 21.

BOLD ACTIONS

These conventions and reports suggest that institutions must (1) engage localities, regions, nations and international organizations; (2) facilitate dialogue and cooperation among national ministries and departments as well as specialized international agencies; and (3) allow decisionmaking to flow from the "bottom-up" as well as "top-down."

Because everything in the ocean interacts with everything else, its environment can be managed and conserved only through cooperation

Ocean policies cannot be dictated by centralized organizations. The ocean is simply too large for any single state or world organization to effectively implement and enforce global ocean policy. Fishing cooperatives, port authorities, shipping companies, seamen unions, grassroots organizations, and indigenous people all must be given ways to meaningfully participate in the formulation of ocean policy. Such initiatives require innovative strategies for cooperation among governments and their citizens. New information and communication technologies make it possible for us to build such frameworks.

The first steps in this direction have already taken place. Decentralized regulations and "co-managed" resources between central governments and coastal municipalities can be found in an increasing number of countries. Interministerial councils, parliamentary commissions and advisory councils have also been introduced. Regional cooperation has entered a new phase as new conventions and programmes increasingly acknowledge regional organizations as key players in the implementation of ocean policies and programmes.

One of the most significant developments in this direction has been the 1995 revision of the Barcelona Convention and the Mediterranean Action Plan, which led to the creation of the Mediterranean Commission on Sustainable Development. This commission's mandate is path-breaking in three ways: It accords representatives of nongovernmental organizations the same rights as government officials, including the right to vote; its members include officials from coastal municipalities and private firms; and it contains not only environmental ministries but nonenvironmental ministries closely involved in issues related to the ocean.

In many ways, the "boundaries" between government and civil society—and between national and international law—have blurred. Such developments have helped clear a path for progress in the next century. That path—or, perhaps more accurately, the most important currents—begins with the ocean.

For some, this may sound like "idealism." But as history often reveals, the only effective path to realism lies in idealism based on the concepts of equalitarism, cooperation and foresight. ■

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ALAGOA'S EDUCATION

Kingsley Alagoa's education began more than 20 years ago in the ancient town of Nembe, located in southern Nigeria, less than 15 kilometres from the Atlantic Ocean. Today, Alagoa is conducting state-of-the-art plasma physics research some 6,000 kilometres from home at the University of Campinas in Brazil. His long journey across the Atlantic has been made possible by the TWAS South-South Fellowship programme. In fact, since its inception in 1986, the programme has helped more than 500 scientists from the developing world conduct research in many of the institutions of excellence that have emerged in the South over the past few decades.

"The South-South Fellowship programme is one of the Academy's most successful," says José I. Vargas, TWAS president and Brazil's Minister of Science and Technology." It gives scientists access to classroom instruction and laboratory facilities that are not available in their home countries."

"At the same time," Vargas adds, "the programme enables research institutions in the South that have attained a certain level of excellence to help their colleagues in other parts of the developing world."

Alagoa, who began his fellowship last June, will remain in Brazil for one year. To take advantage of this opportunity, he received permission to take a year of sabbatical leave from River State University of Science and Technology in Port Harcourt, Nigeria, where he had taught for the past 15 years.

Under the fellowship programme, TWAS pays for Alagoa's round-trip airplane ticket. Meanwhile, the University of Campinas, the local hosting institution, provides Alagoa with a monthly stipend, which is made possible through a cooperative programme between TWAS and Brazil's National Research Council (CNPq). TWAS's relationship with CNPq dates back to the earliest days of the fellowship programme.

"The fellowship," Alagoa notes, "has allowed me to pursue my research in plasma physics, the study of highly ionized gases that are believed to exist within the environments of the sun, stars and the universe's intergalactical regions."

"Plasma's behaviour in distant environments beyond the earth are thought to be more stable than its behaviour on earth, where huge magnetic machines have sought to confine and stabilize plasma so that it could be studied more carefully."

Alagoa adds that "the findings associated with plasma research may ultimately have many concrete applications in the world of science and technology, particularly in energy production and use. For now, however, research into the fundamental principles of plasma physics consume most of the resources and time devoted to this field. That's not likely to change for many decades."

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"Nigerian officials do not believe that the government has sufficient revenues to support such fundamental research. There are simply other matters that the government views as more important. As a result, it has been impossible for me to receive financial assistance for my work at home. My research has been kept alive only through initiatives like the TWAS South-South Fellowship programme."

During his one-year stay in Brazil, Alagoa enjoys the same privileges as other staff members at the University of Campinas. He has access to the college's computer and library facilities, participates in the physics department's workshops and seminars and, whenever he can, takes advantages of the university's extracurricular activities—for example, in music and sports. "While eating lunch at the university cafeteria recently," he noted, "I have sometimes listened to classical concerts performed by members of the music department. The experience reminds me of the lunch-time concerts in London that I enjoyed so much when I was student there."

But most of Alagoa's time is devoted to his studies. "The fellowship gives me the freedom to pursue areas of research where I think I can make a contribution. I largely set my own agenda but receive guidance from my advisor Paulo H. Sakanaka, a professor of physics at the university."

Sakanaka is delighted to have students like Alagoa. "They not only provide the insight and energy that are so vital for the success of a research institution," he says, "but they add to our diversity and make our department—and our university—a more interesting place to be."

"The physics department has about 220 graduate students," says Sakanaka, "and roughly 30 come from foreign countries. Brazil's neighbours—Argentina, Chile, Peru and Bolivia—have the largest representation but we also draw students from Africa, Asia and North America."

"Brazil," Sakanaka maintains, "has come to view the development of strong math and science departments within its universities as investments comparable to other public investments—for example, in transportation and communications. The goal is to create an environment for higher education and advanced technical training that ensures Brazil will have a sufficient number of mathematicians, scientists and engineers to meet the challenges of the 21st century."

Sakanaka's experience as a student some 30 years ago, compared to the experience of his students today, reflects the changes that have taken place in Brazil's university math and science departments over the past several decades. Sakanaka, who is of Japanese decent, was born and raised in Brazil where he received his education through his college undergraduate degree. For advanced studies, however, he went to Columbia University in New York City and then enrolled at the University of New York's Courant Institute of

Mathematical Sciences for post-doctoral work. Studying abroad was the rule, not the exception, during Sakanaka's student days.

"Today," Sakanaka contends, "as our curriculum improves, more and more Brazilian graduate students choose to stay here to receive their advanced degrees. Only then do they travel abroad for their post-doctorate work. In fact, our physics department at the University of Campinas has gained an international reputation. It's especially well-known throughout Latin America."

Sakanaka adds that "since the Brazilian government often gives attractive grants to students, those applying find acceptance increasingly competitive. A critical limiting factor is that the courses are taught in Portuguese. So, students must either have a working knowledge of the language or take an intensive language course before they begin their scientific studies."

As for Alagoa, he is delighted with the opportunities—both professional and personal—that his fellowship has given to him. After completing his year of study, he plans to return to the Rivers State University of Science and Technology in Nigeria, where he hopes that his experience will help encourage talented science students to pursue careers in theoretical physics despite the obstacles they face.

"The improvements that Brazil has made in its university system over the past several decades," Alagoa says, "offer hope that other developing nations can also create nurturing environments that reward faculty and inspire students."

He acknowledges that "the current situation for universities in Nigeria is difficult but not hopeless.

"When we look at universities in the United States or England, we realize that their situation is so far removed from ours, that it's difficult to draw useful lessons from their success. That's not the case in Brazil where just a few decades ago, the desperate state of its university system led many observers to mistakenly conclude that the situation was beyond repair."

TWAS President, José Vargas, expresses a similar sentiment when he says that "recent progress in higher education among a number of developing nations, including Brazil, means that countries throughout the South now have a great deal to learn from one another."

And that's exactly what the TWAS South–South Fellowship programme is designed to achieve. By pooling resources, TWAS and its partnering institutions hope to provide well-qualified researchers in developing countries with opportunities for professional growth and development that they would not otherwise enjoy.

Step by step, South–South cooperation is ensuring that a strong foundation for scientific excellence is being built throughout the developing world. ■

AFRICA'S FUTURE LIES IN AFRICA'S HANDS

Nigerian-born John Ohiorhenuan, who has worked for the United Nations Development Programme (UNDP) since 1989, was recently appointed director of UNDP's Special Unit for Technical Cooperation Among Developing Countries (TCDC-SU). Ohiorhenuan graduated in 1969 from the University of Ibadan in Nigeria, and later received his PhD from McMaster University in Canada. Before joining UNDP, he taught economics at the University of Ibadan for 14 years, and before then at the University of Guyana. He also worked for several years as director of planning in Nigerian's Lagos State. His main area of concern—both as an academic and administrator—has been economic development in the developing world. Throughout his career, he has focused on questions of sustainability, equity, justice and the role of technology and education. Ohiorhenuan recently visited TWAS in Trieste to participate in an advisory committee meeting for the "Sharing Innovative Experiences Among the Developing Countries" project, which is being sponsored by TCDC-SU (see page 4). While there, he sat down with the TWAS editor to discuss a wide range of "development" topics. What follows is an excerpt from their hour-long conversation.

The economic future of many African countries in the 1970s seemed relatively promising. By the early 1980s, however, the prospects had dimmed. What are some of the factors that sparked this moment of optimism followed by a long period of pessimism?

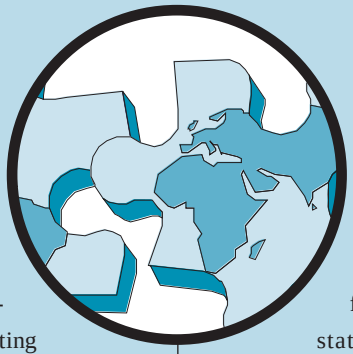
I think several factors drove these trends. In the 1970s, we experienced two major oil shocks and a dramatic spike in fuel prices. As prices for imported goods rose and their ability to pay decreased, African nations found it increasingly difficult to participate in global trade. Oil-producing nations, like my native country of Nigeria, were able to sidestep these trends, but they faced a different problem. Nigeria, for example, did quite well in the short term. However, expectations—and expenditures—were way beyond reality because Nigerians treated the windfall created by oil exports as a permanent rise in income. The problem was compounded by economic mismanagement. Nigeria's government simply disregarded budgets and balance sheets and refused to consider sound monetary policies.

As long as oil prices remained high, such failings didn't seem to matter. But when oil prices took a sharp drop, even Africa's star performers in the 1970s and early 1980s—nations like Nigeria—had to face the harsh reality that their national income and debt were hopelessly out of balance. When the price of what you buy from abroad rises sharply while the price of what you sell to others declines dramatically, you don't have to be an economist to realize you're in deep trouble. And once you're on this downward slope, it's difficult to turn things around. The less money you have, the less likely you are to repay your debts. And the less likely you are to repay your debts, the more certain it becomes no one will lend you additional money. That's why structural adjustments are so important. They enable countries in trouble to right themselves; yet, there's no doubt that such reforms come at a price.

What role did multinational corporations play in all this?

Multinationals have been both an asset and a liability. They are not philanthropists; they are capitalists seeking the highest returns on their investments. That drives multinationals to unabashedly negotiate the best deal for themselves, which usually has spelled trouble for poor African countries that brought little to the negotiating table. The truth is multinationals often got away with things in their dealings with African nations that they couldn't get away with in other developing countries such as China and India.

Take, for example, the issue of technology. Developing nations often seek out multinationals not only because they provide much needed capital over the short term, but because they also offer technological know-how over the long term. Yet, it's not in the interest of multinationals—or anyone else for that matter—to give up proprietary technology unless it's extracted from them. China and India had



the capacity to negotiate relatively good terms for technology transfer—and then the strength to enforce those terms. Africa did not. Governments were too weak, the markets too small and their negotiating experience too limited to gain favourable terms. As a result, African nations rarely got multinationals to agree to produce relatively high percentages of a product—say 30 percent—domestically. And on the rare occasions when such agreements were signed, the multinationals usually disregarded them.

At the same time, there were exaggerated expectations about the willingness of multinationals to invest and re-invest in the economies of African nations. Part of the problem was that multinationals needed confidence that Africa's national economies would remain stable over the long haul. Such confidence was necessary if the multinationals were to develop extended time horizons for their investments. Likewise, governments and people in Africa didn't trust the multinationals—a sentiment reinforced by the multinationals' willingness to take their investments out of Africa at the slightest hint of trouble. So, for the past two decades, there's been a vicious circle of insecurity on both sides.

What role does science and technology play in economic development?

I've always felt science and technology play fundamental roles in the development process. This may have started in my days as a young professor in Guyana, where I was part of a group studying technology policy in the Caribbean. At the time, there was a great deal of debate among academics concerning the "how's and why's" of technology transfer. Despite the heated exchanges, virtually everyone agreed that technology fundamentally means the ability of nations or societies to do more with the same amount of resources. In other words, technology-driven economic development makes nations more efficient and ultimately more prosperous. If you examine the United Kingdom in the eighteenth century, Germany in the nineteenth, or Japan in the twentieth, you see technology played a fundamental role in enabling each of these nations to make a quantum leap from a preindustrial to an industrial state.

Technology also frees individuals from laborious tasks and lets them concentrate on more intellectual endeavours, which is good for both people and their societies. And, finally, effective use of technology implies that there's a critical base of knowledge within a society. All societies that succeed economically have large numbers of people capable of using, adapting and advancing technology. It's not just the machines, it's the ability to use the machines that enable societies to advance.

Of course, societies may buy technology and have the people who sold it to them run it. But that does nothing either for the development process or for the people's well-being over the long term. And it's certainly not sustainable. That's why a prerequisite for technology-based economic development is broad-based scientific knowledge.

Given the experience of the past 10 to 15 years, what is being done now, and what needs to be done in the future, to turn things around in Africa?

In my view, the general pessimism about Africa is unwarranted. We should remember that we're talking about countries that emerged as independent states only 30 or 40 years ago. In that short span, these countries have experienced continual economic and social crises that make it seem as if they are caught in endless cycles of hopelessness.

But it's also fair to say that some African nations—for example, Uganda, Ghana and Botswana—have learned from their experiences and are now paying more attention to the fundamentals of scientific and technology management. I'm not saying they get it right all the time, but there's a growing awareness and willingness to get

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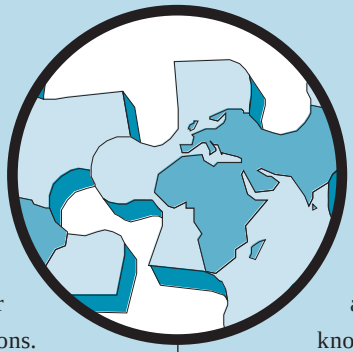

it right. At the same time, the political and social tensions that have paralysed—and at times, ransacked—the continent over the past five decades are easing. More than 30 African nations over the past few years have held elections. The political struggle is by no means over but progress is being made.

At the same time, there's growing awareness that only Africans can develop Africa's economy. Equally important, there's a growing sense that some African problems have African solutions. Stability, however fragile, has returned to the Democratic Republic of the Congo. That was partly a result of African countries feeling it was their responsibility to intervene and restore a semblance of sanity in what used to be Zaire. The same can be said about developments in Sierra Leone and Liberia where neighbouring states agreed that intervention was needed to restore stability.

When you look at these trends—a return to sound economic management, measures for better governance and a growing belief that Africa's future lies in the hands of Africans—you have to be optimistic about the continent's prospects over the next two or three decades.

What role do you think the UN will play in Africa's future?

The UN has one fundamental mandate: international security. But you must remember international security is more than the absence of war. It's the presence of peace and justice. And it involves responding to the needs of society's most vulnerable groups. The UN has a role to play in helping to ensure the creation of fair and good governments and in seeking democratic solutions to difficult problems. It also has a role to play in nurturing development that is sustainable and equitable, not just in Africa but throughout the world.

At the same time, the UN can help advance science and technology, especially through its support for universities and regional networks like the African Regional Centre for Technology and the West African Rice Development Association. The mandate of my group—the Special Unit for Technical Cooperation Among Developing Countries—is to encourage the sharing of experiences and knowledge among developing countries in both Africa and elsewhere in the South.

One issue of particular interest is information technology. Our goal is to help build strong computer networks, especially among African universities and research centers, so that researchers can exchange information and ideas on a continual basis. We're active in this area because we believe such information exchanges are a prerequisite for science- and technology-based economic development.

That same thinking has led us to provide funding for the TWNSO "Sharing of Innovative Experiences Among the Developing Countries" project. The project's emphasis is on experiences that are truly innovative and/or have the potential to be replicated. A major goal is to produce knowledge and information that will allow, for example, people in Burkina Faso to examine the latest developments in China or Mexico.

In this new era of global competition, developing countries must search for new ways to succeed, and that's where South-South cooperation becomes so important. Developing countries like Brazil and India, which have responded well to the new global challenges, have a great deal to share with other countries in the South.

We now face a fluid situation, but within the next 10 to 15 years the rules of the new system will become much more rigid. Those who fail to take advantage of the opportunities that exist today are likely to find themselves even farther behind.

We are at a critical moment in history. As global competition drives economic policies around the world, it's ironic that the path to success in the South lies in cooperation. But that's a reality that nations throughout the developing world should seriously consider as they seek to gain control of their economic futures. ■

NEW GRANT TO PROMOTE ADVANCED UNIVERSITY DEGREES

The Third World Organization for Women in Science (TWOWS) has received a 1.2 million Kronas (US$150,000) grant from the Department of Research Cooperation (SAREC) of the Swedish International Development Cooperation Agency (Sida). The grant will finance a pilot project to help young, educated women in sub-Saharan Africa pursue careers in science.

"There is a great need to nurture an environment that encourages young people in general and young women in particular to pursue careers in science," says Lydia Makhubu, vice chancellor of the University of Swaziland and president of TWOWS. "This project will help us determine what measure can be taken to encourage young women from very poor countries in the South to continue their education."

"Sida-SAREC has long been involved in development issues, particularly in the developing world," adds Goron Hedebro, who serves as the organization's head of the Division of Thematic Programmes. "More recently, our organization has decided to focus its resources on the globe's poorest regions, places like sub-Saharan Africa."

"Our goal is to promote programmes that help provide knowledge and training that participants can use throughout their careers, whether working in classrooms, laboratories, offices or manufacturing plants back home."

The project will operate like this: Grant money will cover the travel costs of fellowship recipients, who will also receive a modest stipend to pay for incidental daily living expenses. Universities and research institutions throughout the South that have agreed to participate in the programme will waive tuition and may provide free room and board.

"This project provides an opportunity to have a substantial, long-lasting impact on both the quality and breadth of basic and applied scientific research throughout the developing world," says Makhubu. "In many countries in the South, women remain an underutilized intellectual resource. Grant projects like this one will help them receive the advanced education and technical training they need to fufill their potential. Not only will individuals be fortunate enough to receive valuable assistance, but their nations will benefit from the productivity and innovation that will surely result from this effort. To a certain degree, the future of the developing world, especially the South's poorest nations, depends on the education and training received by the region's young women."

Applications for the fellowships are now available from the TWOWS secretariat. The deadline for first-round applicants is 30 August 1998. Those who are chosen will be expected to begin their year-long fellowships this autumn. For additional information, please contact:

Leena Mungapen - Third World Organization for Women in Science (TWOWS)
c/o The Abdus Salam International Centre for Theoretical Physics
Via Beirut 6, PO Box 586, 34014 Trieste, Italy
phone 39 040 2240321, fax 39 040 224 559, e-mail: twows@ictp.trieste.it

SOUTH AFRICA TO HOST NEXT GENERAL ASSEMBLY OF TWOWS

The Third World Organization for Women in Science (TWOWS) will hold its Second General Assembly and International Conference between 8 – 11 February 1999, in Capetown, a picturesque port city located on South Africa's southwestern tip not far from the Cape of Good Hope.

Funding for the assembly and conference is expected from South Africa's Department of Arts, Culture, Science and Technology (DACST), the Foundation for Research Development (FRD) and the Academy of Science of South Africa (ASSAf). The TWOWS executive board will be responsible both for the conference programme (the opening and keynote addresses, workshops and poster sessions) as well as the organization's business agenda that will be discussed on the final day.

Lydia Makhubu, TWOWS President, notes that "the major focus of the conference is reflected in its title: *Science and Technology for Sustainable Human Development*."

"Sustainability," she adds, "has become a buzz word not only among policy makers but scientists as well. As a result, it has been difficult to forge a consensus on substainability's meaning and goals. Yet, everyone involved in issues of sustainability agrees on these two factors: science and technology will drive the process, and progress will be difficult to achieve unless the status of women improves, especially in the developing world."

To meet this goal, the conference will seek to increase the visibility of women scientists throughout the developing world and raise the level of interaction among women scientists in the South, particularly those working in the same fields.

"Since the end of apartheid," observes Khotso Mokhele, president of Academy of Science of South Africa, "my nation has launched a host of inter-related political and economic reforms in an effort to create a seamless strategy for progress. The truth is that, over the long term, you cannot advance on the political front without making progress on the economic front. At the

same time, we all recognize that political and economic factors are closely related to both the state of technology and the status of women."

"That's why we are delighted to be hosting this event," says Mokhele. "We're confident that it will make an important contribution to the key issues related to progress in South Africa in particular and the South in general."

The aims of the conference are to:

- Explore new dimensions for women's research in science and technology and education and training.
- Identify additional ways of involving women in science and technology initiatives that seek sustainable development.
- Draw the attention of the international scientific community to the contributions of women to science-based sustainable development.

"The conference," says Makhubu, "will seek to increase the recognition that women in developing nations receive for their contributions to the world of science and technology. We also hope to draw attention to the goals of TWOWS. In fact, a major focus of our concern will be to devise effective strategies to increase the level of assistance for both individual women scientists and scientific institutions in the South that are dedicated to improving the plight of women who choose science as a career."

The final day of the conference will be devoted to the business of TWOWS. Issues to be discussed include the organization's future guiding principles and strategies, particularly its involvement with women's grassroots organizations, and TWOWS's proposed programmatic initiatives between 1998 and 2002. Members will also elect their new executive board at this time.

Participation at the conference is limited to 200 people. All TWOWS's members will receive a formal invitation from the secretariat. Those interested in presenting a paper or poster at the meeting should contact:

TWOWS, c/o the Abdus Salam International Centre for Theoretical Physics (ICTP), Via Beirut 6, PO Box 586
34014 Trieste, Italy
phone 39 040 2240 321, fax 39 040 224 559
e-mail: twows@ictp.trieste.it

Please note that the deadline for the submission of abstracts is 31 August 1998.

PEOPLE, PLACES, EVENTS

SCIENCE IN CHINA

In a brief, yet wide-ranging essay recently published in *Science* (24 April 1998), *Chen-Lu Tsou*, TWAS Fellow (1992) and former director of the National Laboratory of Biomacromolecules in Beijing, China, speaks about the challenges currently facing science in China. Chen-Lu Tsou notes some positive trends—for example, the Chinese government's plan to increase the portion of gross domestic product (GDP) devoted to research and development to 1.5 percent by 2000. In 1995, it was less than 0.05 percent. However, Chen-Lu Tsou notes some disturbing trends as well. He laments that China devotes much more resources to technology and applied scientific research than it does to basic research. In fact, he observes that the link between science and technology is "so intimate in China that the terms have merged into one word, *keji*, which literally means "scitech." He also warns about the rising popularity of "pseudoscience" in China, which shields "superstition and money-making scams under the cloak of respectable science." Such efforts, he says, could do irreparable damage both to science and society in China. Finally, Chen-Lu Tsou observes that China's "open door" educational policy has not only given young Chinese scientists an opportunity to work in universities and scientific institutions elsewhere in the world, but it has exposed them to the material wealth and lifestyles of the North. As a result, many Chinese scientists, once having studied abroad, decide to pursue their careers on foreign soil.

NEW HEAD FOR FUND

TWAS Fellow (1991) *Madhav Gadgil*, professor at the Centre for Ecological Sciences at the Indian Institute of Science in Bangalore, India, has been appointed head of the scientific committee of the Global Environmental Fund (GEF), a US$2-billion fund established in 1991 by the World Bank, United Nations Environment Programme (UNEP) and United Nations Development Programme (UNDP) to coordinate the environmental activities of these three international organizations. In 1994, the GEF became the organization responsible for implementing the environmental treaties emanating from the Rio "Earth Summit," held two years earlier.

The GEF's agenda focuses on four principal areas: conservation of biodiversity, protection of the upper atmosphere's ozone layer, improving the quality of international waters and measures to reduce land degradation. The Fund currently supports 440 projects in 110 countries. Gadgil becomes the first scientist from a developing country to head the GEF's scientific committee. He succeeds Pier Vellinga from the Netherlands.

KAAS PRESIDENT

TWAS Fellow (1988) and Council Member *Mu Shik Jhon*, has been elected president of the Korean Association for the Advancement of Sciences. Jhon, who was educated at Seoul National University in Korea and the University of Utah in the United States, holds an Endowed Chair in Chemistry at the Korea Advanced Institute of Science and Technology. He also directs the Institute's Center for Molecular Science and serves as acting president of the Korea Research Center for Theoretical Physics and Chemistry. Jhon's major fields of interest include the structure and property of water and the role that water plays in the behaviour of molecules.

SIDDIQUI COMMEMORATION

TWAS Founding Fellow and Treasurer *Muhammad Akhtar* delivered the keynote address at the centenary commemoration of the birth of Salimuzzaman Siddiqui at Karachi University in Pakistan. Akhtar told his audience that Pakistan had failed to live up to Siddiqui's legacy in science and technology. He went on to note that "Knowledge is the power which is going to dictate events in the millennium and there is a need to take urgent steps to re-examine our priorities." He applauded the measures that developing nations like Argentina, Brazil and India have taken to promote science and technology within their countries and urged Pakistan to follow in

their footsteps. "In the mastery of science," Akhtar said that Siddiqui and his colleagues "saw the expression of our self-respect and solutions to numerous problems that Pakistan was facing." Their vision of the relationship of science to society, Akhtar concluded, hold true today.

INTELLECTUAL PROPRETY

The protection of intellectual property rights in the Arab world served as the prime topic of discussion at a conference jointly sponsored by the Egyptian Academy of Scientific Research and Technology (ASRT), the Organization of Islamic Conference (OIC) standing Committee on Science and Technology in Developing Countries (COMSATS) and TWAS. The meeting took place in Cairo. Participants agreed that recent scientific advances, particularly in the fields of biotechnology and the use of native plants for medicinal purposes, required Arab nations to create and strengthen their patent offices and to offer more professional training for both administrators and researchers. The absence of such measures, participants concluded, would mean that owners of intellectual property throughout the region would continue to receive inadequate returns on their knowledge and know-how when offering that information in the global market place. Improvements in the management of the Arab world's intellectual property, participants concluded, could be advanced most effectively through the passage of stronger laws and regulations and the creation of cooperative networks among Arab nations.

TURBULENCE WINS PRICE

The American Physical Society, headquartered in Washington, DC, awarded TWAS Associate Fellow (1997) *Fazle Hussain* the 1998 Fluid Dynamics Prize. In a citation accompanying the prize, the Society praised Hussain "for his careful and skilful experiments and interpretative concepts concerning important structures in turbulence and vortex dynamics, and for provoking his students and colleagues to think in fresh ways about turbulence." Hussain, who was educated at Bangladesh University of Engineering and Technology in Bangladesh and Stanford University in the United States, is currently the Cullen Distinguished Professor at the University of Houston in Texas. He is a Fellow of both the American Physical Society and American Society of Mechanical Engineers and Associate Fellow of The American Institute of Aeronautics and Astronautics.

BANGLADESH FELLOWS

TWAS Fellow (1989) *Kamaluddin Ahmad* has been elected President of the Bangladesh Academy of Sciences. Ahmad, who was educated at Dhaka University in Bangladesh and the University of Wisconsin in the United States, is chair and research director of the Bangladesh Institute of Herbal Medicine. He previously served as director of the Institute of Nutrition and Food Science at Dhaka University and vice chancellor of Bangladesh Agricultural University. Trained as a biochemist, Ahmad's major research fields are food and nutrition.

The new Vice President of the Bangladesh Academy of Sciences is TWAS Fellow (1989) *Mohamed Shamsher Ali*, who is a professor of physics at Dhaka University and vice chancellor of the Bangladesh Open University. Shamsher Ali was educated at Dhaka University and Manchester University in the United Kingdom. He has held a number of positions with the Bangladesh Atomic Energy Commission. In addition to his affiliation with the Bangladesh Academy of Sciences, Shamsher Ali is a member of the New York Academy of Sciences and the Islamic Academy of Sciences. His major fields of interest are nuclear physics and the communication of science and technology to the public.

WHAT'S TWAS?

The Third World Academy of Sciences (TWAS) was founded in 1983 by a group of eminent scientists from the South under the leadership of the late Nobel Laureate Abdus Salam of Pakistan. Launched officially in Trieste, Italy, in 1985 by the former Secretary General of the United Nations, TWAS was granted official non-governmental status by the United Nations Economic and Social Council the same year.

At present, TWAS has 479 members from 75 countries, 62 of which are developing countries. A Council of 12 members plus the president is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a small secretariat of 10 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, which is administered by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA). UNESCO is also 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 151 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 nearly 1800 women scientists from 82 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: http;//www.ictp.trieste.it/~twas

FELLOWSHIPS

Want to spend some time at a research institution in another developing country? Investigate the South-South Fellowships: http;//www.ictp.trieste.it/~twas/SS-fellowships_form.html

GRANTS

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

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: http://www.ictp.trieste.it/~twas/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: http://www.ictp.trieste.it/~twas/Lect_form.html
http://www.ictp.trieste.it/~twas/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: http://www.ictp.trieste.it/~twas/SM_form.html

COLLABORATION

You're collaborating with a colleague in another country and would pay a short visit to his/her laboratory? The "Short-Term Fellowships" may be the answer: http://www.ictp.trieste.it/~twas/ST_Fellowship.html