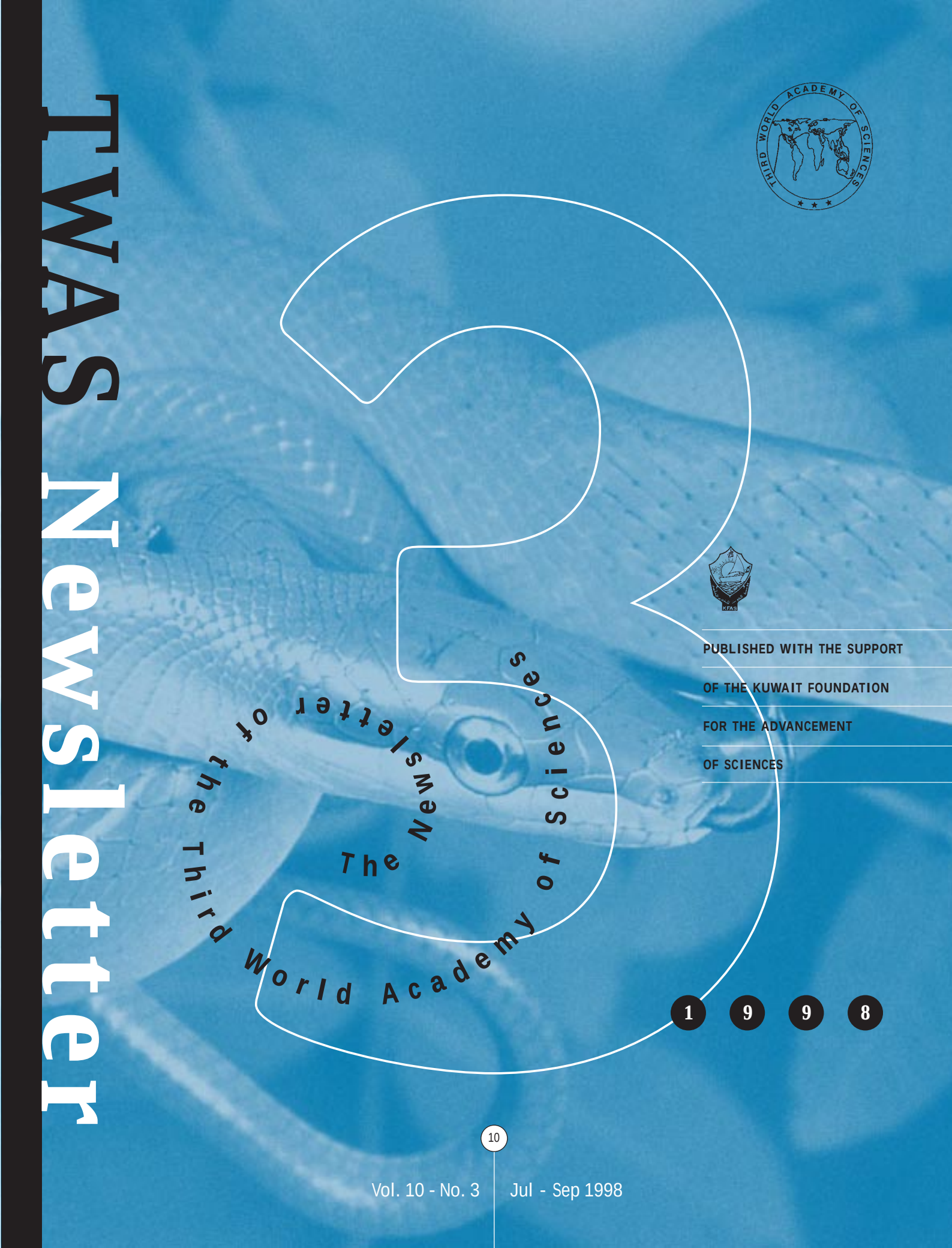
TWAS Newsletter

The Newsletter of the Third World Academy of Sciences



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EDITOR'S NOTE

Meeting the Challenge

Some 100 scientists from around the world will gather in Trieste, Italy, between 9-11 December, for TWAS's Tenth General Meeting. As we put the final touches on the programme, participants can be assured of a busy week. Thirty-six members, elected in 1997, will be formally inducted into the Academy. A new president and council will be chosen. Nine scientists from the developing world, chosen as TWAS Medal and Award winners, will be honoured at a special ceremony and then deliver a series of lectures. Their topics will range from silicon disks to shooting stars.

The programme will also include three other noteworthy activities. Carlo Rubbia, Robert Huber and Werner Arber—all Nobel Laureates—have agreed to address the participants. Rubbia will discuss environmentally acceptable energy sources for developing countries; Huber proteins and the interface between physics, chemistry and biology; and Arber the roots, strategies and perspectives on molecular genetics.

In addition, the programme will feature a half-day international symposium focusing on seismic risk in megacities. Speakers from China, Chile, India, Italy, Sri Lanka and the United States will examine the acute dangers that earthquakes pose for metropolitan areas with teeming populations and flimsy infrastructures. All told, 15 researchers from 11 different countries will discuss a global issue that directly affects thousands—sometimes millions—of people each year.

Finally, at the meeting's concluding session, Maurizio Iaccarino, UNESCO's Assistant Director General for Natural Resources, will provide an overview of the upcoming World Conference of Science to be held in Budapest, Hungary, between 26 June and 1 July 1999. The conference will not only

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TWAS NEWSLETTER

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provide a global forum for analysing the role of science in society, but will seek to build a framework for increasing public awareness and support for scientific research in both the developed and developing world.

The December gathering will be taking place during a historic time for TWAS in particular and scientists in the South more generally.

The recent economic turmoil in Asia, which has since spread to Russia and Latin America, has placed funding for science, particularly basic science, at risk. At the same time, TWAS is at the threshold of receiving permanent status under Italian law.

These two issues may seem unrelated. But the latter would provide the Academy with a permanent funding base that will help ensure our ability to meet the difficult challenges that lie ahead. Meanwhile, recent discussions concerning the global economic crisis have suggested that the only path to sustainable development lies in efforts to improve education and strengthen the role of science and technology in the developing world.

Indeed, the most recent World Bank World Development Report 1998/99, *subtitled "Knowledge for Development," states that knowledge is the heart of economic growth and sustainable development." The report then goes on to say that "how people use and acquire knowledge—and why they sometimes fail to do so—is essential to improving people's lives, especially the lives of the poor." The report places particular emphasis on the need to strengthen and expand the existing base for science and technology throughout the developing world.*

TWAS, as you might suspect, is in full agreement with this assessment. The activities scheduled to take place at our upcoming Tenth General Meeting will highlight our membership's commitment to achieving a better quality of life for all people by advancing the role of science and technology in countries across the South.

Mohamed H.A. Hassan
TWAS Executive Director

EDITOR'S NOTE

AFRICA'S S&T FUTURE

Science and technology policies pursued in many African countries, including my own country of Cameroon, have failed to cope with the sweeping global economic and political reforms that have taken place over the past few decades. As a result, African nations often find themselves falling farther behind the rest of the world when it comes to harnessing the power of science and technology for the benefit of their people.

Cameroon, located in west central Africa, gained independence from France in 1960. The country is home to some 15 million people. Although it is rich in oil reserves and other minerals (including bauxite, iron and timber), it has had a difficult time translating its natural wealth into sustainable economic growth. A prime reason for this failing has been the nation's weak scientific and technological infrastructure.

On the whole, development efforts in Cameroon, like most other African nations, have focused on human resource development and institutional capacity building—primarily the education of scientists and engineers and the construction of research centres and institutes. In effect, policies have been based on the optimistic notion that the findings of scientific research would "trickle down" into the economy to improve the lives of all people. Put another way, there was a belief that investments in research and development (R&D) were directly linked to sustainable economic growth.

Today, we know better. Additional studies and practical experience have taught us that the "growth" process is much more complicated than economic development experts suggested during the 1960s and 1970s. In fact, we have learned that the relationship between R&D and economic growth is neither direct nor self-evident. Successful policies not only require investments in the training of scientists and engineers and the building of research facilities, but the development of private firms, first-rate universities and even consumer demand. Failure to consider all of these factors undermines the goals of any policy for economic growth.

So what can be done to make science and technology policies in Cameroon and other African nations more effective? How can a nation's scientific and technological resources be used to increase knowledge, nurture innovation, raise productivity and serve as valuable tools for sustainable economic development.

First, it is important to note that when it comes to science and technology policies Africa's political leaders, including those in Cameroon, have always articulated worthy goals. They have not, however, put together adequate measures for implementing their programmes.

Three critical factors lie behind a nation's inability to transform its visions into reality. First, there has often been an inability to create strong links between legislative and executive action. It is not sufficient to proclaim worthy goals; you must also develop an effective course of action. Second, there has been a failure to tie scientific and technological goals to national economic plans for development. Third, there has been a reluctance among scientific research institutions to work closely with private-sector manufacturing and service firms.

In short, Cameroon and other African nations have enjoyed some success in promoting the supply side of science and technology through their commitment to national research centres and training facilities. Such measures have had a positive impact on human resources and institutional-capacity building. At the same time, they have too often turned their back to the demand side of science and technology by failing to link R&D directly to the economy.

Bringing science, technology and the economy together in a policy that is both coherent and effective will require measures to increase public awareness of the value of science and technology. It will also involve pursuing reforms that encourage researchers to think in terms of commercialization. The first necessitates nurturing a public culture devoted to science and technology; the second entails introducing incentives that entice researchers to develop projects tied directly to issues of national importance.

Cameroon and other African nations, in short, must develop long-range national technology plans that:

- Place science and technology programmes in closer contact with the nation's industrial and service sectors.
- Promote the diversification and dispersion of industrial activities to ensure that the private sector is ready to receive the information and knowledge that the research institutes generate.
- Encourage researchers to pursue projects that address vital national concerns related to the economy and environment and that tap indigenous resources to resolve these problems.

The old ways of doing scientific research are quickly coming to an end both in Cameroon and throughout much of Africa. Public funding for science is rapidly declining; external sources for support are diminishing; and the role of government is waning as economic liberalization and privatization take hold. Under these circumstances, efforts to live in the past will only mean declining fortunes in the present and future.

Change is upon us whether we like or not. Our only real choice is to respond to the inevitability of change by devising policies that meet the new challenges we face. To do otherwise would mean that we will continue to be victimized by forces that we can neither control nor reverse. ■

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COMMENTARY

WORLD CONFERENCE ON SCIENCE

What will the next millennium hold for science? A world conference in Budapest hopes to shed some light on this intriguing question.

NEXT JUNE, THE UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO) AND THE INTERNATIONAL COUNCIL FOR SCIENCE (ICSU), IN COOPERATION WITH OTHER PARTNERS INCLUDING TWAS, WILL HOLD THE WORLD CONFERENCE ON SCIENCE FOR THE 21ST CENTURY: A NEW COMMITMENT.

The conference, which is to take place in Budapest, is expected to draw some 2,000 policymakers, research scientists, grassroots activists and concerned citizens from around the world. The aim is to improve public understanding of science and to spark renewed commitments among governments for fundamental research (see *TWAS Newsletter,* October-December 1997, page 3). UNESCO has asked TWAS to prepare a background report for the conference focusing on "Science for Development in the South." Newly appointed TWAS Fellow D. Balasubramanian, Director of Research at L.V. Prasad Eye Institute in Hyderabad, India, has prepared a draft statement. What follows is a summary of his discussion.

Why should governments and citizens support science and technology? The answers lie all around us—from successful medical campaigns to eradicate small pox to long-range agricultural programmes that have dramatically reduced the incidence of famine and hunger across the globe.

The South, which is home to three-quarters of the world's population, enjoys a long history of achievements in science and technology. In fact, through the early centuries of this millennium, universities and institutes of learning in China, India, Egypt and Islamia rivalled those in the West. Researchers there made notable contributions to mathematics, astronomy, chemistry, metallurgy and botany.

The strong historical links between science and society in the South have weakened considerably over the past millennium, and in some developing nations they have been completely broken. As we enter the next millennium, one of the main goals of the scientific community must be to strengthen and reestablish those links. Such efforts will help address issues of poverty in places where it is most acute. At the same time, these initiatives will prove invaluable for dealing with some of the most intractable global environmental problems of our time, including the damage we have inflicted on our atmosphere and oceans.

The South has several qualities that should help it in its efforts to revitalize its scientific and technological capabilities. For example, in an era dedicated to sustainable development, the South enjoys deeply rooted traditions in managing and sustaining biodiversity. Developing nations have also retained their skills in traditional crafts and early technologies—for example, the use of village wells in India and aqueducts in the Mediterranean for harvesting and preserving water; the development of traditional plants and herbs for medicinal purposes throughout the tropics; and the historic reliance on environmental sensitive building materials in Egypt, China and Central Africa.

Only through a sharing of information and knowledge…can we hope to revitalize science and technology in the South….

At the same time, developing nations have learned to live lightly upon the land. Traditional societies often display deep regard for the environment and dedicate much effort to recycling and replenishing the resources that their people take from nature. Such attitudes should serve them well as they seek to use science and technology to improve the lives of their people.

So what's to be done to expand the application of science and technology in the South? First, we must recognize the varying degrees of sophistication and effectiveness among countries in the South both in terms of knowledge and infrastructure. Kenya is not China and the Congo is not Argentina when it comes to science and technology capabilities. We cannot treat all of these nations as one. It also means that some advanced developing nations have a great deal to teach others in the South that have yet to enjoy the same degree of progress.

The status of science and technology in many developing nations is often a reflection of a nation's literacy rates, economic well-being and level of political stability. As a result, improving the quality of science and technology often requires investments in other initiatives as well. No level of funding for science and technology is likely to have a big payoff if most people within a nation remain poorly educated.

The South brings some strengths to efforts to build a permanent scientific and technological infrastructure. These strengths include respect for nature and traditional, environmentally sensitive practices that should help ensure resource sustainability into the next millennium. However, the South also carries some worrisome liabilities that place the prospects for progress at risk. These liabilities include public indifference toward state-of-the-art science, weak and woefully underfunded educational systems and scant understanding of property rights or patents.

Two key measures that would help the South overcome its handicaps would be the expansion of international science and technology networks capable of sharing knowledge and resources, and strategies linking science more closely to national and regional concerns. The latter, which would require closer ties between universities, research institutes and the private sector, would help boost solid public support for science and technology funding.

As an old Indian saying goes, "let noble thoughts come from all sides." Such sentiments should serve as a source of inspiration for the discussions that are planned at UNESCO's *World Conference on Science for the 21st Century: A New Commitment* next June and July. Only through a sharing of information and knowledge, generated by a spirit of cooperation, can we hope to revitalize science and technology in the South in ways that improve the everyday lives of people who have yet to fully experience the fruits that such research can bear. ■

EASING THE BURDEN

TWAS, national science academies and research councils have joined forces to help young researchers throughout the developing world.

TWO OF THE PRINCIPAL AIMS OF THE THIRD WORLD ACADEMY OF SCIENCES (TWAS) ARE TO PROMOTE THE CAREERS OF YOUNG SCIENTISTS IN THE DEVELOPING WORLD AND TO HELP SCIENTIFIC INSTITUTIONS IN THE SOUTH STRENGTHEN THEIR DECISION-MAKING AND RESEARCH CAPABILITIES. THESE TWO GOALS COME TOGETHER IN THE TWAS PRIZE FOR YOUNG SCIENTISTS.

The initiative was launched in 1986. As the title suggests, the goal of the programme is to aid the careers of young, talented scientists in the developing world. The selection process takes place not in the TWAS secretariat, located in Trieste, Italy, but at national science academies across the South. Academy officials, with the help of an advisory committee, select their most promising young researchers for special recognition. In addition to the publicity they receive, the award winners are given a cash prize of about US$2000.

"Over the past 12 years, some 28 scientific academies have participated in the programme." says Mohamed Hassan, the Executive Director of TWAS. "For example, we have worked with national science academies in Colombia, Ethiopia, Jordan, Nepal, Pakistan, Senegal and Uruguay."

"I don't want to underestimate the value of the cash award," Hassan adds. "The money researchers receive often enables them to continue working in their research fields as they seek more permanent sources of funding. But the project also helps raise the public profile of national science academies throughout the South. That, in turn, has long-term value for institutions that often find it difficult to make their voices heard."

The prizes, which number about 10 each year, are rotated among the four fields of "pure" basic science: biology, chemistry, mathematics and physics. "We are not talking about a great deal of money," notes Hassan. "The annual programme budget is less than US$25,000. Yet, we receive a good return on our investment—in terms of both basic science and the promotion of national research agendas."

Bruno Lomonte Vigliotti, who turned 40 this fall, received a TWAS Young Scientist Award in 1998, from the National Council for Scientific and Technological Research (CONICIT) in San José, Costa Rica. CONICIT recognized Lomonte for his research on the biochemistry and immunology of toxins present in snake venom. What follows is a discussion of his scientific explorations into an end-

lessly fascinating subject, which inspires both fear and loathing among large segments of the world's population. Put another way, most of us prefer to deal with snake bites from a distance. Lomonte, as you will see, takes a more hands-on approach to the problem.

Born in Naples, Italy; raised in San José, Costa Rica; awarded a Ph.D. in immunology at the University of Göteborg in Sweden....Bruno Lomonte Vigliotti, Director of the Research Division at the University of Costa Rica's Instituto Clodomiro Picado, sees no reason for people to be surprised by his trans-Atlantic journeys.

"My family lived for generations in southern Italy," explains Lomonte. "But when I was eight, my father, who at the time was an ice-cream salesman, saw greater economic opportunities in Central America. So, my family packed their bags and moved to Costa Rica. Later, when my father believed that the restaurant business would be more lucrative—and perhaps more fun—he opened a *trattoria* near our home."

A similar dynamic—marked by a comfortable mixture of personal drive, opportunity and circumstance—helped to determine the direction of Lomonte's career path.

"From my earliest school days I was always interested in science. My grades and the recognition I received from my teachers spurred my enthusiasm," notes Lomonte. "Then, in 1976, when I entered the University of Costa Rica for my undergraduate studies, I chose microbiology as my major. The decision was not a difficult one for me. During the earlier part of this century, under the leadership of Clodomiro Picado (for whom my institute is named), the university had established a regional reputation in microbiology—and more specifically the study of snake venoms. That reputation continued to grow, making microbiology the strongest scientific field at the university."

Lomonte began his career as a laboratory assistant at the University of Costa Rica's Instituto Clodomiro Picado, soon after receiving his undergraduate degree in 1981. He has remained at the institute ever since except for a one-year Fulbright Scholarship at the University of Wisconsin in the United States, and a three-year stint at the University of Göteborg in Sweden, where he was awarded a doctorate in immunology in 1994. His studies in Sweden were made possible in part by a grant from Costa Rica's National Council for Scientific and Technological Research (CONICIT).

"By the time I entered the doctorate programme, I had a masters degree in hand and had been appointed an associate professor. I realized, however, that I would have to obtain a doctorate if I hoped to advance any further. Fortunately, CONICIT offered me financial support to continue my education."

Today, Lomonte serves as the Director of Research at the institute to which he has devoted virtually his career. The institute's staff consists of about 30 people, including seven full-time researchers.

"Our work can be divided into two major activities: antivenom production and research," says Lomonte.

"We serve as Central America's major centre for the production and distribution of antivenom. In fact, every year we ship some 50,000 ampoules or capsules, each containing 10 millilitres of antivenom, to hospitals, medical clinics and universities throughout Central America. In addition, the institute undertakes basic research largely designed to enhance both the production and effectiveness of these biological agents, as well as to understand the mechanisms driving the venoms and toxins."

A key part of the institute's antivenom production facility consists of a ranch with approximately 40 horses that serve as "antivenom studs." Each horse receives a small dose of venom two or three times a month over a six-month period. As a result of this procedure, the horses build an immunity to the venom that is expressed biologically through the creation of antibodies in their blood streams. When these antibodies reach a sufficient level, the horses' blood plasma, which contains the antibodies, is removed and purified. The antivenom can then be consumed by humans for counteracting the debilitating effects that sometimes accompany poisonous snake bites.

"Our production and research facilities are linked in several ways," explains Lomonte. "First, the sale of antivenom enables the institute to generate a small amount of income that is used in part to finance our research. Our scientific studies and laboratory experiments—modest to begin with—would be curtailed even further without this money."

"Second, our basic research agenda is largely shaped by our desire to increase the yield and improve the quality of the antivenom we harvest from our horses. For example, we have conducted research to reduce the time it takes to produce a sufficient level of antibodies in the horses' blood stream. In addition, the injections that horses receive when building their immunities to the venom place them at risk for infection and lesions. Reducing that risk

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would improve the health of the horses and increase the amount of antivenom that we are able to extract."

Lomonte's own research has focused on the impact that snake venom has on muscle destruction, or what the medical research community refers to as myonecrosis. He is excited by some recent findings that suggest a snake bite's adverse effects are triggered within particular molecular regions located in the protein toxins. "If we can identify the source of the problem at a molecular level," he says, "we raise the prospects for developing a 'blocking action,' which may neutralize the venom's adverse impacts. That, in turn, could lead to more effective treatments."

...the challenges faced by young scientists in the developing world have never been greater....

The TWAS Award for Young Scientists, which Lomonte won earlier this year, has drawn attention both to his research and institution. At the same time, it has enabled him to leverage the funds in ways that has helped him to work with other institutions with similar research agendas. For example, in 1997 Lomonte worked closely with colleagues in Costa Rica, France and Spain on a project that explored the ability of snake venom components to kill bacteria. "Without the TWAS funding," he says, "it would have been difficult—if not impossible—to pursue this partnership."

Lomonte, in fact, laments the fact that in small countries like Costa Rica, "basic research is not a priority. These countries, which often have limited resources and deep-seated economic and social problems, believe that their money is better spent on more pressing social problems or on applied scientific research that promises more immediate results."

He cites the current woes of his own institute as an example of the financial difficulties faced by scientific research centres in small developing countries across the South. Beyond the money derived from the sale of antivenom, his institute has just a few government grants, each of which totals less than US$1000. "We're fortunate." Lomonte observes. "We have our own modest self-generating source of income. Three research fellowships from the International Foundation for Science (IFS) in Sweden, each amounting to roughly US$12,000 a year, also help a great deal. Other research institutes are not so lucky. And even in our case, available resources are not enough to satisfy the needs of a modern research facility."

Such situations, which persist throughout the developing world, led to the creation of the TWAS Award for Young Scientists more than a decade ago. For a small sum of money, the Academy hopes to ease—at least for a brief time—the financial burden faced by many young researchers throughout the South. At the same time, the programme seeks to bring greater public attention to the Third World's national science academies, which researchers in the South often use as a lifeline for information about their disciplines and colleagues.

In many ways, the challenges faced by young scientists in the developing world have never been greater—and the competition for funds never more acute. As a result, the benefits derived from the TWAS Award for Young Scientists remain as important today—perhaps even more important—than they were when this modest initiative was launched more than a decade ago. ■

SCIENCE IN ISLAMIC WORLD

For the past 20 years, TWAS Fellow (1985) Atta-ur-Rahman has served as Director of the H.E.J. Research Institute of Chemistry in Karachi, Pakistan, which has become one of the most prestigious research institutes in the developing world. Since 1996, Rahman has also served as the Coordinator General of COMSTECH, the ministerial standing committee on scientific and technological cooperation for the Organization of Islamic Conference (OIC). Under Rahman's leadership, COMSTECH has rapidly emerged as one of the most respected voices for the advancement of science and technology in the South. During a recent visit to TWAS in Trieste, Italy, Rahman spoke with the editor of the TWAS Newsletter about both the state of basic science and overall science policy in the developing world. What follows is an excerpt of their 90 minute discussion.

Could your briefly discuss your educational background and the steps that led you to become Director of the H.E.J. Institute?

I was born in India, in 1942, but my family moved to Pakistan five years later soon after the subcontinent's partition. We lived in Okara, a small town about 120 kilometres from Lahore. Since there were no schools there, my father arranged for me to have private lessons. In fact, my formal schooling did not begin until I was nine, when my family moved to Karachi. After that, I went through the British system of education and received my elementary and high school degrees from a grammar school affiliated with Cambridge University in England. In the early 1960s, I obtained my undergraduate university degree, with top honours, from Karachi University, and was awarded a Commonwealth scholarship to attend Kings College at Cambridge, where I attained my Ph.D. in 1968. Upon graduation, I worked as a research fellow at Cambridge for five years. Then, in 1973, I returned to Pakistan to join the University of Karachi's H.E.J. Research Institute of Chemistry. Since my first years at Karachi University, I had dreamed of building a world-class chemistry research institute in my home country. Salimuzzaman Siddiqui, founding director of the Institute, had laid the ground work for such a place. When he asked me to join the Institute and later appointed me as his codirector, I realized this would be the best opportunity I would ever have to fulfill my dream.

Please describe what the institute was like when you arrived.

There were four faculty members, who were also affiliated with the university, 10 students and half a dozen technicians. They worked in four laboratories equipped with a couple of small infrared and ultraviolet spectrometers. For starters, I needed a nuclear magnetic resonance spectrometer and mass spectrometer. At Cambridge, I had written several hundred letters to businesses and foundations inquiring about possible funding for laboratory facilities in Pakistan. One morning while sitting at my desk in Karachi, I received a letter from

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VG Micromass, a newly formed company in Cheshire, England, expressing interest in helping us meet our equipment needs. After brief discussions, they agreed to give us a mass spectrometer virtually free of charge. We paid only 3,500 pounds (less than US$5000) compared to the standard price of over 30,000 pounds. Our costs covered the technician's airfare and the transportation and warranty charges for the machine itself. Similarly, I needed a nuclear magnetic resonance spectrometer. For that I arranged a loan from the National Bank of Pakistan. Thus within six months of my return to Pakistan, we had two large research instruments in hand. At the same time, we began writing grant proposals to large international funding agencies. Our philosophy was to aim at the skies and hope we could reach the clouds. We were perpetually optimistic. The German government came through first in 1976 with a grant of US$2 million. Funding officials there saw our potential and were willing to invest in our future. During the late 1970s, we began to build a track record of success and convinced other funders that the Institute was worthy of their consideration. Between 1980 and 1988, we received grants from Japan, United Kingdom and United States. Germany also gave us additional money. All told, over the past 15 years, we have received roughly US$35 million in outside funding.

How has the mandate of the Institute evolved over time?

Because the Institute is part of Karachi University, one of our primary missions is to train young researchers. In the 1970s, we had five Ph.D. students; today, we have more than 100. To ensure high standards, we have put several measures in place. First, all our articles are published in ranking international journals. Second, all our doctoral dissertations are evaluated by two top experts from the North. In fact, Ph.D. examinations are held externally. Third, faculty members are appointed under contract and don't receive tenure until they have proven their worthiness. Our faculty, moreover, are evaluated on the basis of international standards. When we invite outside evaluators to judge our researchers, we ask them whether this person would receive tenure at their university or institute if he or she were up for tenure. Finally, we give very high consideration to technicians. The Institute's most senior technician receives the same salary as I do. Since they're maintaining instruments worth tens of millions of dollars, we think it makes sense to recruit and retain the highest quality workers possible. Our strategy has paid off. Just recently, after rigorous evaluations spearheaded by TWAS, the Institute was selected as the site for an International Centre for Chemical Sciences. We are now developing a 20-acre campus to fulfill this mandate.

What kinds of activities does your Institute engage in today?

We currently have some 250 students and staff members. The permanent faculty, which numbers about 15, remains small. We have done this deliberately to help ensure quality. The result is that we're small in number but large in terms of the level of our research activities. We've forged many international linkages. The Institute has ongoing programmes with

Cornell University and Scripps Institute. It has joint projects with Pennsylvania State University and has launched a cooperative initiative with the National Institutes of Health in Washington, D.C. Our research efforts are largely directed to synthesizing bioactive substances. For example, we seek to synthesize new compounds that may combat cancer or thwart the progress of AIDS. We have a programme designed to isolate and examine existing plant compounds that may be used for medicinal purposes. The Institute also conducts research examining the structure of proteins in the human body and engages in pharmacology projects exploring how cells communicate with one other.

What obstacles have stood in the way of replicating research institutes like yours throughout the developing world?

The main problem has been a lack of political vision. Too often, political leaders in the developing world have viewed education as an expenditure, not an investment. When you add up the gross domestic product (GDP) of the 55 member countries of the Organization of Islamic Conference (OIC), it totals about US1150 billion. France's GDP is US$1500 billion, Germany's US$2400 and Japan's US$5100. As Coordinator General of COMSTECH, a committee consisting of the ministers of science and technology in OIC's 55 member states, I keep reminding the ministers that if they're going to make significant economic headway in the years ahead, it won't be through oil exports. The name of the game is high technology. Can you build automobiles as good as Honda's? Computer chips equal in speed and storage capacity to those manufactured by Intel? Lenses comparable to those that bear the name of Bausch u. Lomb? Such high tech items demand skilled labour, first-rate manufacturing facilities and institutional infrastructures that promote and reward innovation.

Under these circumstances, where do you begin?

By educating our leaders. We must convince them that sustained progress can only be achieved through investments in education. In the past, Western countries offered substantial support to countries like Pakistan, particularly for higher education. But most Western nations have altered their aid strategies. The last thing they want to do is create another Japan. Developing countries must understand where the world is moving and devise long-range plans to create indigenous high tech products and services without assistance from the North. The most important prerequisite for success in this new environment is the development of human resources. That means you must devise a balanced approach to investments in education—one that recognizes the importance of primary education but does not short-change universities. The latter, after all, is where teachers are trained, and without well-trained teachers you cannot develop the skilled workers you'll need to compete on a global scale. For all of these reasons, developing nations must simultaneously strengthen their schools and universities while developing high-tech centres in such select fields of research as computer science, biochemistry and microelectronics. The annual budgets of universities in the developing world average between $US5 and US$10 million. In

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contrast, the current budget of Cornell University in the United States is about $US1.2 billion. Given these facts, it doesn't make sense to say that institutions of higher education in the developing should wait until improvements in primary education are in place.

How does your involvement with COMSTECH fit into your previous experience and what do you hope to accomplish through this organization?

I enjoy complex challenges and I view my work at COMSTECH as a logical extension of my years of experience at the Institute. More importantly, I think COMSTECH is strategically placed to promote the goals that I have advocated throughout my career: the advancement of high-level science and technology in the developing world. Since I was appointed in July 1996, I have begun several projects designed to move the organization from broad discussions of scientific policies to initiatives that have tangible impacts on scientific research. For example, we have launched a spare parts programme to help scientists in OIC countries maintain their research equipment; a training programme to enable technicians stay current in their fields by attending workshops in OIC member countries; and a professor-exchange programme to enliven the intellectual environment at universities. Each of these programmes will soon be conducted as joint projects with TWAS. In addition, we have begun a bilateral science and technology cooperation programme among member countries that encourages them to exchange information in areas where they have particular expertise. And we have started a research-support programme, funded by the Islamic Development Bank, that provides stipends to young Islamic scientists who remain in their own countries. Our agenda covers a broad canvas. But it's important to remember that OIC member states are home to about 1 billion people, a fifth of the world's population. Our membership includes both poor countries like Sudan and relatively rich ones like Saudi Arabia. Yet all OIC member states share a common interest in linking basic scientific research to technological development.

What is the future of science and technology in the Islamic world?

I would like to see Islamic countries move from agricultural-based economies to industrialized economies based on science and technology. Such an effort ultimately would generate more capital for improving the economic and social well-being of the Islamic people. A successful strategy for attaining this goal involves several interrelated factors. For example, investments in education will nurture a highly skilled labour force. A highly skilled labour force, in turn, will possess the know-how to create high-value goods and services. The capital generated by the sale of these goods and services will supply member nations with the funds they need to sustain economic growth. Such a pattern of progress is readily available for all those who are interested in examining it. The crucial issue lies in having the vision and commitment that enable you to fit all of the pieces together. That's where I hope I can make an important contribution both as director of the H.E.J. Research Institute of Chemistry and Coordinator General COMSTECH. ■

NEW VOLUME ON SOUTH'S CENTRES OF EXCELLENCE

The Third World Network of Scientific Organizations (TWNSO), in collaboration with the South Centre and Third World Academy of Sciences (TWAS), has announced the publication of the second edition of Profiles of Institutions for Scientific Exchange and Training in the South. *With 431 entries from 52 countries, the book represents a unique inventory of the capabilities and accomplishments of the most prominent research and training centres in the developing world.*

"The new volume contains more than twice as many institutions as the first edition" notes José I. Vargas, President of TWNSO and TWAS. "The higher total," he goes on to say, "reflects a more vigorous effort on our part to encourage institutions to send us information. Given the success of the first volume, many institutions were eager to respond. We thank them for their efforts and hope they are pleased with the results."

Julius K. Nyerere, Chairperson of the South Centre, contends that "As with the first edition, we anticipate that the second volume will not only serve as a compendium of past progress, but will help nurture the expansion of scientific networks throughout the South by providing researchers and institutions with information about other people and places involved in activities similar to their own."

To be sure, the South's scientific and technological infrastructure continue to face serious problems that not even the region's centres of excellence have fully overcome. For the most part, both the equipment and overall working conditions in the South's scientific research facilities lag far behind those in the North. Pay remains inadequate, especially for those facilities seeking to compete with their counterparts in the developed world for the 'best and brightest.' In addition, some areas of the developing world—rural districts in general and sub-Saharan Africa in particular—rarely have joined in the progress that has become characteristic of the South's more dynamic regions over the past few decades.

Despite such shortcomings, Vargas notes that "All those involved in the campaign to raise the level of science and technology in the developing world should be proud of the progress that has been made. We can all be assured that the momentum now in place makes it even more likely that the pace of change will be even more dramatic in the future. As a result, our next volume describing the South's centres of scientific excellence should contain even more examples of state-of-the-art research facilities." ■

For additional information about the *Profiles of Institutions for Scientific Exchange and Training in the South*, please contact:

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THEMES, SPEAKERS SET FOR TWOWS CONFERENCE

THE THIRD WORLD ORGANIZATION FOR WOMEN IN SCIENCE (TWOWS) WILL HOLD ITS 2ND GENERAL ASSEMBLY AND INTERNATIONAL CONFERENCE BETWEEN 8-11 FEBRUARY 1999.

The assembly and conference, sponsored by South Africa's Department of Arts, Culture, Science and Technology (DACST) and the Foundation for Research Development of South Africa (FRD), will mark one of the largest gatherings of women scientists in the world. More than 250 women, largely from the South, are expected to attend.

The title of the conference is Science and Technology for Sustainable Human Development. A major subtheme will be the key role that women, particularly women researchers, play in efforts to promote science-based economic development in the South.

"Over the past three decades," notes TWOWS President Lydia Makhubu, "social scientists have discussed at length the critical importance of women in the economies of the developing world—not only for the purposes of child-rearing but for conducting everyday tasks—from cooking to cleaning to wood-gathering. Such activities, researchers contend, have kept both families and societies intact."

"What has often been overlooked in these analyses," Makhubu adds, "is that women also play a critical role in the scientific communities of many developing nations, particularly in Africa and Asia. In biology, environmental sciences and even chemistry, women scientists continually make important contributions in their fields. Moreover, in many instances, women have a strong sense of the importance of making science work for the societies in which they live. These are the kinds of issues we hope to highlight at the conference."

Among the noteworthy speakers who have been invited to address the conference are Thabo Mbeki, South Africa's Deputy President; Gro Harlem Brundtland, Director-General, World Health Organization; Lionel Mtshali, South Africa's Minister of Arts, Culture and Science and Technology; and Graça Machel,

South Africa's First Lady and former Minister of Education in Mozambique.

Meanwhile, the conference's technical sessions—consisting of four workshops—will focus on issues related to health, education, environment and information technologies.

On the final day of the assembly, 11 February, outgoing President Lydia Makhubu will present the organization's reports and recommendations for future activities. And later that day, the election results for TWOWS's new president and executive board will be announced. The final ceremony will include a brief address by the new president and closing statements by Nkosazana Zuma, South Africa's Minister of Health and Bridgit Mabandla, Deputy Minister of DCAST.

"TWOWS was launched in 1993 at a conference in Cairo, Egypt. Today nearly 1800 female scientists from some 82 Third World countries are members of the organization," Makhubu says. "We are proud of the progress we have made in promoting the importance of women in science throughout the South."

"The upcoming conference in South Africa," Makhubu adds, "will mark our arrival as a mature organization ready to tackle the difficult, yet surmountable, problems related to science and sustainability in the South. We look forward to setting groundwork for even more rapid progress in the years ahead." ■

For additional information about the conference, please contact:

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Sheikh Riazuddin

UNESCO AWARD

Sheikh Riazuddin (TWAS Fellow, 1989), Professor and Director of the National Centre of Excellence in Molecular Biology at the University of Punjab in Lahore, Pakistan, has been named a co-recipient of the Carlos J. Finlay Prize. Riazzudin shared the prize with Etienne Pays, Director of the Laboratory of Molecular Parasitology at the University of Brussels in Belgium. The semi-annual award, granted by the United Nations Educational, Scientific and Cultural Organization (UNESCO), is designed to promote research and development in the field of microbiology through its recognition of outstanding individuals or groups. Riazuddin, who was educated at the University of the Punjab and University of Reading in the United Kingdom, has served as a Scientific Officer in the Pakistan Atomic Energy Commission and Pakistan's Nuclear Institute for Agriculture and Biology. He is also a fellow of the National Academy of Medical Sciences in Pakistan. Riazuddin's research has focused on strategies for increasing agricultural yields while minimizing the dangers associated with the use of chemical pesticides.

ALLOTEY HONOURED

Francis K. Allotey (TWAS Fellow 1988) has been chosen as one of the first recipients of the World Bank-International Monetary Fund Africa Club award. The purpose of the award is to bestow recognition on distinguished African-born scientists. The awards ceremony, which honoured four scientists in addition to Allotey, will take place at the Marriot Wardman Hotel in Washington on 24 October 1998. Allotey, who was born and raised in Ghana, received his undergraduate degree from Imperial College in the United Kingdom and his masters and doctorate degrees from Princeton University in the United States. He has been a professor at the University of Science and Technology in Kumasi, Ghana, for the past quarter century. Allotey has also served as chairperson of Ghana's Council for Scientific and Industrial Research and the Ghana Atomic Energy Commission; president of the Society of African Physicists and Mathematicians; and coordinator of the Ghana Energy Group. In addition, he is a governor of the International Atomic Energy Agency (IAEA) and a member of the Abdus Salam International Centre for Theoretical Physic's (ICTP) Scientific Council. His research areas include theoretical physics, nuclear and renewable energy and information technology.

ECOLOGY AWARD FOR RAO

TWAS Founding Fellow Calyampudi R. Rao, who holds the Eberly Chair in Statistics and directs the Center for Multivariate Analysis at Pennsylvania State University (USA), has been given the International Association for Ecology Distinguished Statistical Ecologist Award. Rao, educated at Andhra and Calcutta universities in India and Cambridge University in England, has made pioneering contributions to mathematics and statistical theory that have been integrated into graduate and postgraduate courses in statistics, econometrics and electrical engineering around the world. His research has focused on linear algebra, multivariate statistical analysis and signal processing. Rao has received 20 distinguished honorary doctorate degrees from 15 universities in 15 countries, and is a member of the National Academy of Sciences (USA), a foreign member of the Lithuanian Academy of Sciences and Honorary Fellow of the American Academy of Arts and Sciences.

Calyampudi R. Rao

PEOPLE, PLACES, EVENTS

WORLD TEACHER'S DAY

5 October 1998 has been designated World Teachers' Day—a day designed to bring public attention to the critical work performed by the world's 50 million teachers. A joint statement recently issued by the United Nations Educational, Science and Cultural Organization (UNESCO), International Labour Organization (ILO), United Nations Children's Fund (UNICEF) and United Nations Development Programme (UNDP) praised teachers not only for their classroom instruction but for the critical role that they play in mediating conflict among today's youth by emphasizing the value of dialogue in settling disputes. The statement went on to say "That each time a teacher succeeds in creating a tolerant, supportive classroom environment, each time a teacher enables children to develop their self-esteem, their communications skills and ability to solve problems, a fundamental act of peace-building takes place." The organizations urge countries throughout the world to make concerted efforts to improve salaries and working conditions of teachers who for too long—in too many places—have suffered from poor pay and substandard classroom environments.

INDIA'S NUCLEAR TESTS

In an interview published in *Newsweek*, TWAS Fellow (1995) Rajagopal Chidambaram, who heads India's Atomic Energy Commission, defended his nation's decision to conduct nuclear tests. The tests took place in May. He said that

Rajagopal Chidambaram

India's decision was made "in the interests of national security" and that "the majority of his people" backed the initiative. He also noted that India did not violate any treaty provisions because his nation had not signed either the National Non-Proliferation Treaty or the Comprehensive Test-Ban Treaty. A one-page excerpt of the interview can be found in *Newsweek*, 14 September 1998.

SCIENCE FOR PEOPLE

Dorairajan Balasubramanian (TWAS Fellow, 1998), who serves as Director of the Centre for Cellular and Molecular Biology in Hyderabad, India, has been named laureate of the United Nations Educational, Scientific and Cultural Organization (UNESCO) Kalinga Prize. The prize is issued annually to individuals who have made significant contributions to the popularization of science. Balasubramanian, who received his doctorate degree in chemistry from Columbia University in the United States, has worked extensively as a science columnist for daily newspapers and a writer and contributor to science television programmes in India. He has also participated in grassroots movements designed to increase public awareness of the value of science among lay citizens. His research interests have focused on the human eye, biomolecular spectroscopy and protein structure and interactions. Balasubramanian is a fellow of the American Association for the Advancement of Science, Indian Academy of Sciences, Indian National Science Academy and Indian National Academy of Sciences. He is also a member of the Indian Science Writers' Association. In 1995, Balasubramanian was given a TWAS Award in Basic Medical Science for his contributions to our understanding of cataracts and his research on potential dietary plans for thwarting the disease. Balasubramanian is the author of TWAS's background report for the UNESCO/ICSU World Science Conference (see page 6 of this issue).

Dorairajan Balasubramanian

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