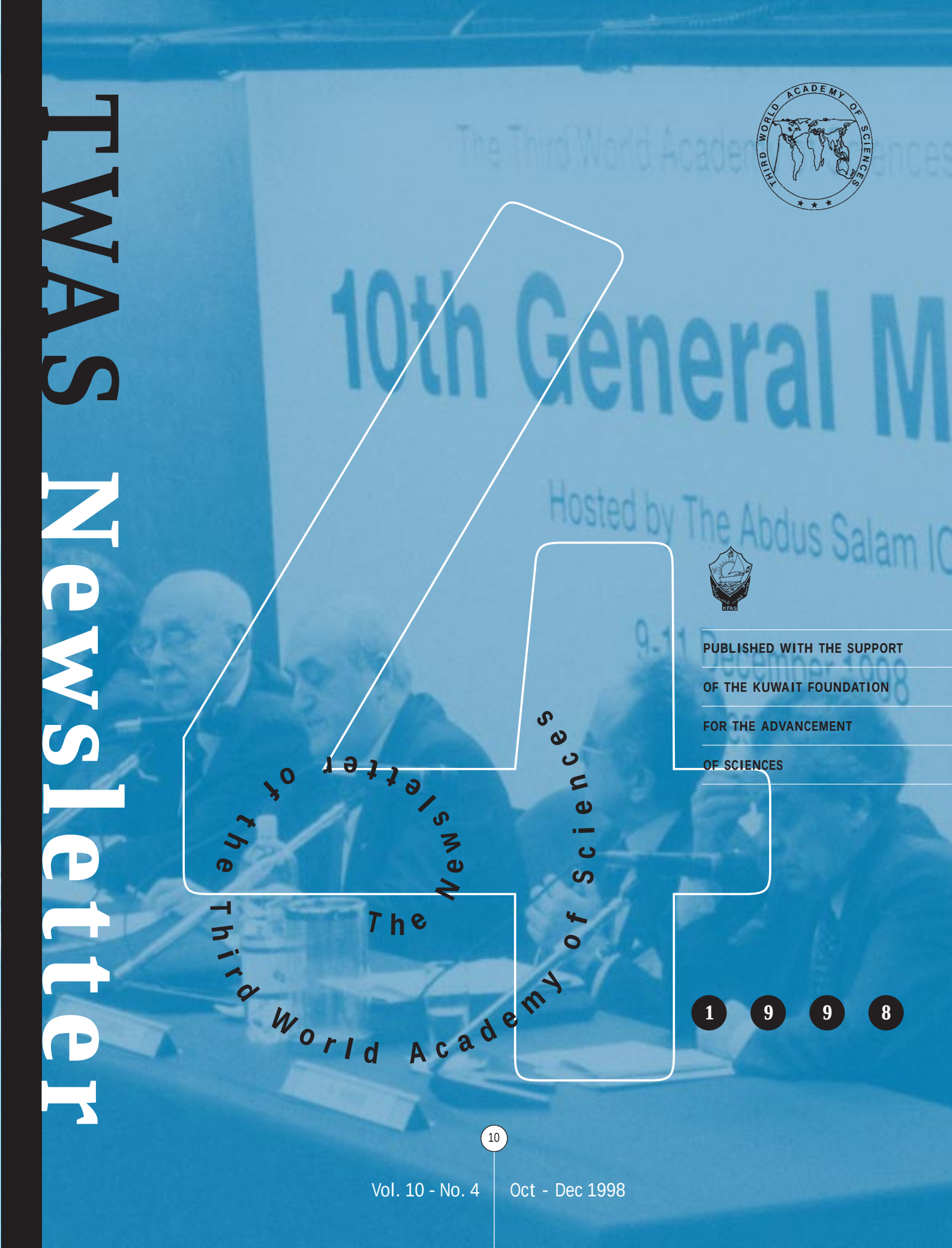
TWAS Newsletter



The Newsletter of the Third World Academy of Sciences

PUBLISHED WITH THE SUPPORT OF THE KUWAIT FOUNDATION FOR THE ADVANCEMENT OF SCIENCES

1998

10

Vol. 10 - No. 4 | Oct - Dec 1998

EDITOR'S NOTE

Momentous

Too often, too many people have used the word "momentous" to describe what amounts to a commonplace occurrence. As a result, the word has been devalued, making it ever more difficult to convey the potential impact of truly important decisions.

Yet, I don't think it's too much to say that the Italian government's announcement on the first day of TWAS's 10th General Meeting—Tuesday 9 December—was a "momentous" event for the Academy. Here's why.

Since its inception in 1983, TWAS has done a lot with a little. Being elected a member of the Academy, which lies at the heart of TWAS's reason for being, has become one of the most distinguished honors any scientist from the developing world can receive.

At the same time, the Academy's awards programs have elevated the prominence of third world scientists globally and, perhaps more importantly, boosted their prestige in their home countries. Our research fellowships and travel grants have opened doors, particularly for young scientists at critical stages in their careers, that otherwise may have been shut. Our South-South exchange programs have enabled scientific institutions to reach levels of research excellence that would have been much more difficult to achieve on their own. And our book and journal donation program has given institutions in the South opportunities to stay in touch with advances in research and technology taking place around the globe.

The Academy's success is due in no small measure to the enthusiasm and commitment of its members and the dedicated work of its executive director, Mohamed H.A. Hassan, and a surprisingly small seven-person secretariat.

As in all endeavors, however, money counts. Since its inception, the Academy has been fortunate to be on the receiving end of annual voluntary contributions from the Italian government, which in recent years have amounted to 1.9 billion lire (US$1.2 million). This money often has been supplemented with program-specific grants from such organizations as the Department of Research

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PUBLISHED QUARTERLY WITH THE SUPPORT OF THE KUWAIT FOUNDATION FOR THE ADVANCEMENT OF SCIENCES (KFAS) BY THE THIRD WORLD ACADEMY OF SCIENCES (TWAS)

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Cooperation (SAREC) of the Swedish International Development Agency (Sida), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the Kuwait Foundation for the Advancement of Sciences (KFAS).

Money has not only often been tight, but budgetary flows from year to year have remained uncertain. Economic slumps, spikes in inflation and changes in government have sometimes placed the Academy's budget at risk due to circumstances beyond its control.

In 1993, in the aftermath of its most serious financial crisis, the Academy decided to launch a US$10-million endowment fund campaign. The goal was to create a source of independent funds that would enable TWAS to smooth over the bumps in the road that often surface from one budget cycle to the next. The fund, which now totals some US$4 million, has made great headway but still has a long way to go.

All of these circumstances have kept the Academy on its toes, which no doubt has energized its efforts. But staying on your toes all the time is exhausting. Besides it's difficult to make steady progress unless both feet are planted firmly on the ground.

That's why the Italian government's announcement at the TWAS's 10th General Meeting was so important. Italy's decision to increase its annual contribution to TWAS from 1.9 billion lire (US$1.2 million) to 3 billion lire (US$1.9 million) over the next three years is indeed welcome news. Any organization would warmly embrace such a healthy increase in funding.

Yet, equally important, the Italian government also announced that it would begin to take the necessary steps to make TWAS funding a permanent part of the government's annual budget—a decision that virtually assures the Academy's long-term future. As an added measure of good news, the Brazilian government announced that it would provide TWAS with a grant to recharge the Academy's endowment fund campaign. The hope is that the campaign's US$10-million goal can be reached in the next few years.

With the Academy's programmatic budget now on solid ground and with renewed hope that the endowment fund will be able to reach its long-sought goal, it's no exaggeration to say that these are indeed "momentous" times for TWAS.

Additional, more stable funding should allow us to run the full gamut of our activities with greater skill and confidence than ever before. That means TWAS will be able to serve the cause of scientific and technological development in the South even more effectively than we have in the past.

José I. Vargas
TWAS President
Brasilia, Brazil

WOMEN IN SCIENCE

When I assumed a leadership role in the Third World Organization for Women in Science (TWOWS) in 1993, the problems facing female scientists in the developing world were starkly evident: too few women scientists often found themselves working in too much isolation with little hope for advancement.

Today, such problems remain, although I'm happy to report that some progress has been made on the "numbers front," thanks in part to the efforts of TWOWS. There are indeed more women working in science in the developing world, particularly in the fields of biology, public health and environmental research.

Overall, however, the percentage of women scientists throughout the South remains dishearteningly low and much work must be done to ensure that the numbers continue to rise in the future. The limited progress we have made, in fact, has been fragile and the risk of losing ground is ever present.

That's why TWOWS must continue to encourage young women to enter and stay in scientific fields. For these reasons, I have been encouraged by the recent grant that TWOWS received from the Department of Research Cooperation (SAREC) of the Swedish International Development Agency (Sida) to provide assistance to young women in sub-Saharan African to pursue careers in science. The grant offers fellowships to women who have recently received bachelors degree to enable them to pursue advanced university degrees in science without incurring personal economic hardships.

The SAREC-Sida grant is a prime example of the "nuts and bolts" activities that TWOWS must pursue to boost the number of women in science throughout the developing world. Yet, as I have gained more experience in my capacity as TWOWS president, I have come to realize that such efforts will never be sufficient to ensure that our organization's lofty principles are fully realized.

Put another way, from its inception, TWOWS activities have been designed to assist women scientists in their efforts to "make it" in a world dominated by men. In the future, I would like to see increasing efforts by TWOWS and its members to "change the rules of the game" in ways that fundamentally alter the core principles and practices of the scientific community.

What will such efforts entail? First, the scientific community must become more involved with addressing social and environmental problems and less preoccupied with examining abstract academic questions. Second, the reward system within science must be altered to guarantee that women are not penalized for "taking time out" to raise a family. Third, the scientific hierarchy must be flattened so that the so-called "hard sciences"—physics, chemistry and biology—do not maintain a higher status than their "softer" cousins—environmental science and public health research.

The changes I am advocating are not simply designed to pave the way for women to enter scientific fields in larger numbers. Equally important, they're intended to make science more relevant for society. Such efforts will undoubtedly strengthen the entire scientific enterprise and provide equal benefits to male and female scientists alike.

Since its inception, TWOWS has helped raise the status of women in universities and scientific research institutes across the South. Our organization may now be ready to take on an even more difficult task: raising the status of science within the developing world.

Such an initiative may provide the ultimate leadership role for women in science and, at the same time, offer TWOWS opportunities to influence scientific research in ways that our founders could have only dreamed of at the organization's inaugural meeting a little more than a decade ago. ■

Lydia Makhubu
President - Third World Organization for Women in Science
Professor of Chemistry - University of Swaziland

TWAS TENTH GENERAL MEETING

Wide-ranging talks by three Nobel laureates and good news on the financial front highlight the annual gathering of TWAS fellows.

Trieste, Italy. Two noteworthy events—one scientific, the other financial—highlighted the 10th General Meeting of the Third World Academy of Sciences (TWAS). The meeting was held on the campus of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, between 9-11 December 1998. More than 100 scientists from 40 nations attended the week-long event.

On the meeting's first day, three Nobel laureates—Carlo Rubbia (Physics 1984); Robert Huber (Chemistry 1988) and Werner Arber (Medicine and Physiology 1984)—addressed the participants.

Rubbia examined the enormous challenges now facing the global community in its efforts to meet the future energy needs of the developing world. Those needs are expected to grow enormously over the next few decades. Huber explored the intricate links among physics, chemistry and biology that are becoming increasingly important with the rise of biotechnology and bioengineering. And Arber spoke about the scientific, economic and ethical challenges posed by advances in molecular genetics, a field that may well dominate biological research in the years ahead (see "Nobels Speak," p. 10, for more detailed descriptions of their presentations).

Earlier that morning, Gianfranco Facco Bonetti, head of the cultural relation's division of the Italian Foreign Ministry, announced that his government had agreed to increase TWAS's annual budget from 1.9 billion lire (US$1.2 million) in 1998 to 3 billion lire (US$1.9 million) over the next three years. Facco Bonetti also announced that the Italian government would begin to take the necessary steps to write the Academy's charter into law. Such action would create a stable funding base for TWAS research and training activities by converting what has been the Italian government's annual voluntary contribution into a long-term financial commitment protected by law.

Given these events, it's little wonder that TWAS president, José I. Vargas proclaimed that these were "exciting times for the Academy" and noted that TWAS was "within sight of the vision presented by Abdus Salam at the Academy's first meeting in Trieste in 1985."

During the meeting, TWAS members also:

- Elected a new 13-person Council that will shoulder responsibility for leading the Academy into the 21st century. Vargas was again named president. TWAS founding fellow and vice-president C.N.R. Rao, Albert Einstein research professor and president of the

[*continued next page*]

Jawaharlal Nehru Centre for Advanced for Advanced Scientific Research in India, was unanimously appointed to the new position of president-elect. Rao will assume the presidency of TWAS when Vargas's current term expires in two years (see "TWAS Council," p. 20).

• Awarded five 1999 lectures in basic science (medicine, biology, chemistry, mathematics and physics) and three medal lectures (in medical science, chemistry and engineering) to internationally recognized scientists—all from the developing world. In addition, TWAS founding fellow Thomas R. Odhiambo, president of the African Academy of Sciences and professor emeritus of insect physiology at the University of Nairobi in Kenya, was given the honor of delivering the third Abdus Salam Medal Lecture for Science and Technology. Odhiambo received this distinction in recognition of his contributions to the advancement of science and technology in Africa. Each of the honored lecturers will make their presentations at the next TWAS General Meeting and General Conference.

Excellent presentations offered vivid proof of the high-quality research now taking place across the South.

• Listened to some 15 first-class lectures on topics ranging from nonlinear chaotic dynamics, to gravitation and cosmology, to new, promising therapies for diabetes that draw on the knowledge of traditional medicine men (see "Native Plants for Our Global Village," p. 13).

• Participated in a half-day symposium focusing on the risks posed by earthquakes in many of the world's megacities, especially in the rapidly growing, poorly constructed, metropolises of the South, where buildings, roads, and water and sewer systems are often too flimsy to withstand the earth's inevitable tremors.

• Heard an update on the United Nations Educational, Science and Cultural Organization (UNESCO)/International Council for Science (ICSU) World Conference on Science, which is scheduled to take place in Budapest, Hungary, in early summer. The update was presented by the conference's two chief organizers: Maurizio Iaccarino, UNESCO's assistant director-general for science, and Werner Arber, president of ICSU. TWAS has been asked to play a major role in the organization of two of the conference's sessions: "Science in Response to Basic Human Needs" and "Science for Development."

Meanwhile, the TWAS Council:

• Selected an additional 39 scientists for membership as TWAS Fellows—31 from the developing world and 8 (holding the titles of Associate Fellows) from the developed world. Current TWAS members, now totalling 479 (including 15 Nobel laureates), will vote on each of the nominees this winter. Those selected will be officially welcomed into the Academy at the next General Meeting and General Conference.

In addition to these activities, each of TWAS's four permanent committees met the day before the official opening of the conference—on Monday 8 December—to examine a host of issues vital to the Academy's future. Discussions focused on strategies for strengthening the Academy's finance and program activities and upgrading TWAS procedures both for the election of fellows and the granting of awards. Committee members expressed particular concern for re-energizing the TWAS endowment campaign. Although the campaign is now more than one-third of the way towards its

US$10-million goal, it has not received any substantial contributions for the past several years.

TWAS president José I. Vargas announced that the Brazilian government would provide the Academy with a grant to be used for soliciting additional investments to the endowment fund. Vargas also noted that he would be devoting a good deal of time during his remaining two years as TWAS president encouraging governments and foundations—both in the South and North—to contribute to the fund. "With my departure as Brazil's Minister of Science and Technology effective at the end of 1998," he observed, "I will now have more time and energy to give to this effort."

TWAS is now within sight of the vision presented by Abdus Salam at the Academy's first meeting in Trieste in 1985.

On another "activity front," the executive board of the Third World Network of Scientific Organizations (TWNSO), a non-governmental alliance of some 150 scientific organizations in Third World nations launched in 1988 with the help of the Academy, met to examine the future course of their organization's efforts to promote science-based economic development throughout the South. Five ministers of science and technology from three different continents in the developing world attended the session, as did a number of presidents and directors of science academies and chancellors of universities.

At the TWNSO meeting, Farouk El-Baz, chairperson of TWNSO's Committee on Environmental Hazards and Global Change and Director of Boston University's Center for Remote Sensing, announced he was optimistic that the Global Environmental Facility (GEF) would soon provide TWNSO with a multi-year grant to examine the state of biodiversity in arid and semi-arid ecosystems.

More specifically, the goal of the grant will be to identify and disseminate information on the best available practices for conserving and sustainably utilizing biodiversity in such ecosystems. It will also seek to develop strategies for increasing cooperation among research centers of excellence that concentrate on resource issues related to drylands. Scientists from the Middle East and North Africa will be heavily involved in the project.

"A great deal of time and money has been spent studying biodiversity in tropical regions, with impressive results not just in terms of science but in terms of growing public awareness," El-Baz told those in attendance. "This GEF-sponsored TWNSO project will be designed to draw attention to the same issue in arid and semi-arid ecosystems. Like their counterparts in the tropics, dryland ecosystems also enjoy a rich heritage of biological diversity that has been placed at risk by habitat loss and environmental degradation. The project," El-Baz observed, "hopes to add new and important dimensions to one of the most critical environmental issues faced by the global community today."

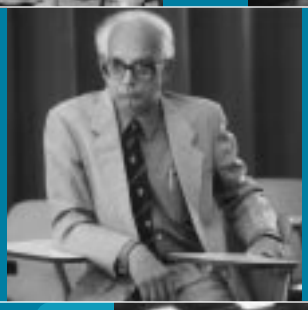
The Academy's 10th General Meeting would not have been possible without the valuable support of a host of sponsors, notably The Abdus Salam International Centre for Theoretical Physics (ICTP); Area di Ricerca Scientifica e Tecnologica; Assicurazioni Generali; Azienda di Promozione Turistica Trieste; Azienda Regionale di Promozione Turistica; Cassa di Risparmio di Trieste; Centro UNESCO di Trieste; Fondazione Internazionale Trieste per il Progresso e la Libertà delle Scienze; Insiel; International Centre for Genetic Engineering and Biotechnology (ICGEB); International Centre for Science and High Technology (ICS/UNIDO); Ital TBS S.p.A.; Lloyd Adriatico; Pertot Srl Ecologia/Servizi; Reporter Studio di G.F. Pace; Sincrotrone Trieste; and Telital.

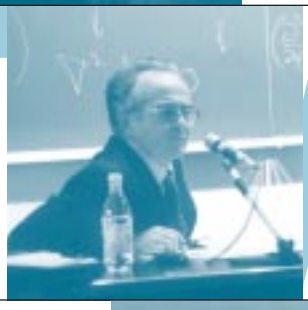
"All in all," noted Mohamed H.A. Hassan, the Academy's executive director, "it was a busy and productive week. The Nobel Lectures and the Italian government's announcement concerning the Academy's future funding were certainly the highlights of the meeting."

"But what struck me even more," Hassan observed, "was the strength and vitality of the less publicized aspects of the conference. Excellent presentations by scientists working throughout the developing world offered vivid proof of the high-quality research now taking place across the South—research that TWAS has often played an instrumental role in supporting. Such studies and findings bode well both for the future of science in the developing world and, even more importantly, the positive impact that we all hope science and technology will have on the future economic and social well-being of the South."

As a final item, the TWAS Council announced that the next General Meeting of TWAS will take place in Dakar, Senegal, in November 1999. One of the conference's primary goals will be to explore effective strategies for science-led sustainable development in Africa. Plans also call for a comprehensive review of the state of science and technology in Senegal and, more generally, throughout sub-Saharan Africa.

The meeting will be organized in collaboration with AFRISTECH, TWNSO, the African Academy of Sciences and the Third World Organization for Women in Science (TWOWS). It is expected to draw some 300 scientists, largely from the developing world. ■





TWAS TENTH GENERAL MEETING

NOBELS SPEAK

TWAS's 10th General Meeting was highlighted by presentations from three Nobel laureates on topics of critical importance to both science and society.

Carlo Rubbia. Robert Huber. Werner Arber. Here's a brief summary of what the three Nobel laureates said on Global Energy, Proteins and Genetic Engineering.

ENERGY DEMAND

"Research, research, research. That's what the world will need to meet its future energy needs."

Nobel Laureate Carlo Rubbia (Physics 1984) offered this assessment at the conclusion of his presentation, which took place on the opening day of the 10th General Meeting of the Third World Academy of Sciences (TWAS). The location was the Main Lecture Hall of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. More than 200 people were in attendance.

Rubbia noted that today's annual energy consumption worldwide averages 1.6 tons of oil equivalent per person. That average, however, masks huge differences in energy consumption that exist between continents and regions. In North America, for example, annual energy consumption averages 8 tons of oil equivalent per person; in Europe, the average is 3 tons; and in southeast Asia, it is 0.3 tons.

"Annual per-capita energy consumption worldwide undoubtedly will rise over the next century," Rubbia noted. "And the greatest rates of growth will occur among nations in the developing world.

Why? Because most experts now estimate that 3 tons oil equivalent energy consumption per person per year is what it takes to live comfortably." The truth is that citizens in the developing world have a desire—and indeed a right—to strive for per-capita energy consumption levels that allow them to attain a quality of life comparable to citizens in the developed world.

Anticipated increases in global population growth, moreover, add to the energy challenges that the world will face over the next century. "The good news," Rubbia observed, "is that global population will not grow exponentially as many scientists feared just a few years ago." In fact, most experts now believe that the world's population will reach 10 billion by 2100 and then remain at that level into the foreseeable future.

"Population may reach a steady state over the next century," Rubbia contended, "but energy consumption will not." In fact, he projected that total energy consumption will rise from 10 gigawatts worldwide in 2000 to perhaps 30 gigawatts by 2100. A critical question is: Where will this energy come from?

Rubbia praised the value of energy conservation and efficiency but he said that such efforts would not be enough. He noted that "a light bulb today uses less energy than one 20 years ago, but there are many more lights. Similarly, a car uses less gasoline but there are far more cars."

Coal, one of the few energy sources we have in abundance, offers another possible answer to our future energy challenges. But as Rubbia asserted, "coal is a mess," and any efforts to dramatically increase its use would come at the expense of the global environment—extracting a high price in terms of air pollution and global warming.

Rubbia also discounted the potential of geothermal energy, a resource that scientists estimate is much too small to contribute

significantly to the world's energy needs. And, he offered a pessimistic assessment of solar energy, which he characterized as "a very disperse energy source" that is extremely difficult to harness. He pointedly noted, for example that "if Japan wanted to produce all of its energy with solar energy, it would have to cover a third of its land surface with photovoltaic panels."

Rubbia then turned his attention to conventional commercial nuclear technology, which he quickly concluded was no longer "a viable option." Public concerns for safety and the environment have made the existing nuclear energy option too expensive. Moreover, the increasing need to mine excessive amounts of land to extract sufficient amounts of uranium has caused energy companies worldwide to turn their back on this once promising energy source.

What options, then, does the global community have for meeting its future energy needs? Rubbia contended that solutions may lie in innovative nuclear technologies—both fission and fusion—that could draw on abundant sources of thorium or lithium, instead of uranium, to produce large quantities of energy at an acceptable cost and without undue harm to the environment.

He admitted, however, that "industrially speaking" such potential solutions to the world's energy challenge were "pie in the sky." And that's why he concluded his remarks by noting "innovation is the most powerful renewable resource."

PROTEIN PRODUCTION

While Rubbia spoke about the natural resources that drive our economies and often determine our material and social well-being, Nobel Laureate Robert Huber (Chemistry 1988) examined the protein-driven "cellular" engines that propel our biological processes and play an instrumental role in the health and behavior of all living organisms.

"Proteins," Huber observed, "are the molecules of life. In fact, they perform virtually all the functions we associate with life, including our ability to move and to think."

"Yet, for all of the difficult functions they perform, proteins are—chemically speaking—simple structures." Huber described proteins as "linear polymers with only 20 different building blocks—amino acids—that are held together by peptide bonds."

"However, these 20 different amino acids," he went on to say "can be arranged arbitrarily in a chain to create infinite sequences or versions of proteins. In fact, the number of protein sequences exceeds the number of atoms in the universe."

Each of these sequences or chains, moreover, is characterized by unique properties and well-defined three-dimensional structures. The latter, in fact, must remain fully intact for a protein to function properly.

The critical role that proteins play in biological, life-giving processes means that they are central both to our well-being and behavior. At the same time, the infinite variety of sequences that characterize proteins makes their study both fascinating and challenging. In short, knowing more about proteins could have a dramatic impact on the quality of our lives.

Huber traced the history of the study of proteins to the discovery of x-rays, which took place in a small town in Germany in 1895. The ability to see "inside" a person's hand and gaze at the bones beneath the skin's surface captured worldwide public attention. What was not known then and would take nearly a century to uncover was that x-rays not only make skin transparent but could make crystals and molecules transparent as well.

Not until the development of light-sources created by synchrotrons, which occurred just a few decades ago, did scientists fully appreciate the "molecular value" of x-rays. And even then, Huber notes, "biologists usually took a backseat to physicists when it came to the use of these machines." Biologists, in fact, often were considered scientific "parasites" and given access to the machines only when physicists were not using them.

Well, times have changed. Today, biologists are primetime players when it comes to synchrotron research busily trying to unmask the physical structure of protein sequences through a process known as crystal diffraction, which allows them to observe a diagram of the protein chain and thus examine biological, chemical and physical processes in great detail.

Thanks in part to synchrotrons, the pace at which the scientific community is accumulating knowledge about proteins has accelerated rapidly over the past decade and is expected to pick up additional steam in the future.

But, as Huber stated, there's a lot to learn. Protein structures, for example, come in multiple sizes and shapes, which makes general observations difficult. Some proteins reside in water, some don't, some reside partially in water. Proteins sometimes originate from the same source but evolve into more complex structures by the addition of new elements. There are some proteins that serve as an organism's internal police force, eliminating other proteins that an organism doesn't want. (As Huber observed, cells often are full of "junk proteins.") Then, there are other proteins that serve as an organism's medical ward helping other proteins find their proper structure. Many proteins, moreover, have multiple functions, so that uncovering the biological process driving one of their functions marks only the beginning. And virtually all proteins

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find a way to partner with others in a building process with endless possibilities.

Few scientists deny that the challenge posed by proteins are well worth pursuing, not only for the contributions that it makes to our understanding of multiple fields of science—including biology, chemistry and physics—but because of the impact it may have on combating diseases that have caused a great deal of pain and suffering worldwide.

GENETIC ENGINEERING

Nobel Laureate Werner Arber (Medicine and Physiology 1978) offered the third in a series of back-to-back-to-back "Nobel" lectures presented during the first day of TWAS's 10th General Meeting. His topic was genetics. More specifically, he addressed the recent advances in genetic engineering that have revolutionized our understanding of the structure and function of genes. That, in turn, has opened a new world of application that promises to have wide-ranging impacts on health, agriculture and natural resource use.

Arber noted that the field of classical genetics dates back to the late 19th century when scientists first began to systematically observe the mutations that invariably take place among genes—causing, for example, a flower with red petals to produce offspring with white petals. But it was not until the 1940s that scientists learned, through their study of bacteria, that donor bacteria could pass gene fragments (or DNA) to recipient bacteria through vectors. This and several other genetically determined pathways provide the means for occasionally altering or mutating genetic structures and functions.

For Arber and other biologists, genetic mutation is nothing new. Nature has been pursuing avenues for biological change ever since life forms took root on earth. But a critical question has been whether nature tolerates or resists the horizontal transfer of genes from one species to another. The answer, in effect, is that nature does both.

On the one hand, vectors encourage the process. On the other hand, the ability of enzymes to distinguish between a cell's own DNA and foreign DNA discourages it. The latter enables enzymes to degrade the foreign gene fragment or, conversely, to recombine with the DNA of the recipient gene. If the latter takes place, a genetic mutation may follow.

But nothing is guaranteed. First, a process of natural selection will determine the rate of initial success. Second, for the mutation to have permanence, the alteration in structure must be passed from one generation to the next.

As Arber pointed out, the field of biotechnology, which began in earnest during the 1970s, drew both its inspiration and techniques from the knowledge and insights that scientists had acquired through their study of gene structure and behavior in nature. Modern biotechnology, in fact, is based on two key principles of classical genetics: that genes provide vectors for the transfer of material and that DNA itself can be fragmented and recombined to provide the organism in question new genetic structures with altered functions.

What makes genetic engineering, or what scientists sometimes call "reverse" engineering, different from classical genetics is this: In classical genetics, scientists largely play the role of passive observers examining phenomena that take place randomly in nature. Sure, scientists may help refine the process by cross-breeding species that display the characteristics they want to accentuate. But such a strategy remains imprecise, and the ability to direct the outcome limited at best.

In genetic engineering, however, scientists play a proactive role in the transfer of genes, carefully selecting the DNA segments that they want to transfer and then injecting those segments into a recipient gene, which they have also carefully chosen. Or, they specifically alter a resident gene to change its functional characteristics.

As Arber stated, in classical genetics, scientists "rely on the organisms provided by nature." But in genetic engineering, scientists "direct the mutagenesis to explore the changes that may take place as a result of their efforts."

Arber acknowledges that the process could result in the creation of genetic mutations that carry long-lasting negative effects. But he points to the rigorous standards and guidelines for study and experimentation that scientists established some 25 years ago as convincing evidence that biotechnology can be pursued without exposing humans or nature to great risks. He noted, for example, that "no major accident in the field has ever taken place."

Arber concluded his presentation by observing that the benefits of biotechnology—in the fields of public health, food production and environmental sustainability—are virtually limitless. That may explain why biotechnology is among the "hottest" fields of science today—one that has captured the imagination of both researchers and citizens worldwide. ■

NATIVE PLANTS FOR OUR GLOBAL VILLAGE

Researchers are discovering that traditional healing practices hold secrets that may help push the frontiers of modern medicine.

IT'S A DISEASE THAT AFFECTS 120 MILLION PEOPLE—ABOUT 2 PERCENT OF THE WORLD'S POPULATION. AND THAT FIGURE IS EXPECTED TO DOUBLE WITHIN THE NEXT DECADE.

The symptoms are disturbing: dizziness; parched throat; loss of appetite and sex drive. The long-term health effects are dangerous and sometimes fatal: blindness; kidney failure, cardiovascular disease and limb amputation.

The disease is diabetes, which is the fourth leading cause of death in the developed world and the fifth in the developing world.

As many people have learned through personal experience, diabetes is a sinister, chronic disease that can sometimes be slowed through diet and exercise, but at more advanced stages must be treated with daily doses of insulin administered either orally or through injections.

For those afflicted with diabetes—and for family members who share the distress and anguish that it often causes—any information concerning potentially more effective new drugs or treatments is welcome news. That's why TWAS Fellow (1989) Suzanne Urverg-Ratsimamanga's discussion of a new antidiabetic drug based on the active agents or molecules found in a native plant of Madagascar could prove both appealing and important. Urverg-Ratsimamanga, who was awarded a 1998 TWAS Medal Lecture, gave her presentation at the Academy's 10th General Meeting held in Trieste, Italy, this past December.

"Traditional medical healers in Madagascar," Urverg-Ratsimamanga explains, "have been using the seeds of the native plant, *Eugenia jambolana*, for generations as the centerpiece of an effective therapy for counteracting the slow debilitating impacts of diabetes."

When a patient comes to a healer complaining of dizziness, thirstiness, or a loss of appetite, a simple diagnosis is made. The healer asks the patient to urinate on an ant hill. If the ants flee, the healer likely concludes another illness is responsible for the patient's malaise; if the ants remain, then the healer concludes the insects are feeding on the sugar in the patient's urine, which strongly indicates the onset of diabetes. "The seeds of *Eugenia jambolana*," Urverg-Ratsimamanga notes, "are then made a regular part of the patient's diet."

Over time, the healer's use of this traditional "plant therapy" has shown consistently encouraging results. Indeed, diabetic-related symptoms often disappear—or are significantly mitigated. As a result, patients have often experienced a return to health.

For the past two years, Urverg-Ratsimamanga and her husband Albert Rakoto-Ratsimamanga, a founding member of TWAS, have been searching for ways to prepare extracts or develop new mole-

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cules from *Eugenia jambolana*. With the help of others, they have also sought to determine whether it is feasible to commercialize the plant's antidiabetic agents on a global scale. Their efforts have received preliminary regulatory approval from the Malagasy government. Now, they have signed a legally binding partnership agreement with a pharmaceutical firm in Europe that they hope will lead to the production of a new antidiabetic drug. The drug has already received an international patent under the trademark Madaglucyl®. If all goes according to plan, Madaglucyl® could be on the market in three years.

This is by no means the first time that the Ratsimamangas have worked together to develop and distribute medical products and therapies based on biological elements found among native Malagasy plants used by traditional healers.

In fact, since its inception more than 40 years ago, funds for their Malagasy Institute of Applied Research have been generated exclusively from the sale of medicines produced from active agents found in Malagasy's indigenous plants. For example, Madecassol®, a major healing drug derived from the active agents of the Malagasy plant, *Centella asiatica*, has been used as an effective treatment for intense burns, leprous wounds and inflamed ulcers for more than two decades. Royalties earned by the institute for the critical role that its researchers played in the development of Madecassol® has generated thousands of dollars in annual revenues for the institute.

Rakoto-Ratsimamanga describes the process like this: "We have developed a relationship of trust with our country's traditional healers based on years of cooperation. In the past, when we heard about an indigenous plant that has been used for medicinal purposes among local populations, we went to the healer to learn more about the therapies. Today, because of our success and honest dealings, nearby residents often come to us with plants that they think may have potential medicinal value. That not only makes our job easier but it offers an indication—in fact, the best indication I know—that our work has not only been profitable but well received by our neighbours."

"The facilities at the institute include a laboratory where we test and analyze promising plant specimens," Rakoto-Ratsimamanga continues. "If our early efforts lead to promising results, we seek preliminary approval from the Malagasy government to continue. We then negotiate a mutually beneficial licensing agreement with a Northern pharmaceutical firm for the development, manufacture and distribution of the plant's health-healing elements."

"Developing a drug—either from natural plants or synthetic materials—is a time-consuming, costly venture," explains Urverg-Ratsimamanga. "For this reason, we often rely on the capital and expertise provided by Northern pharmaceutical firms for this aspect of our work. At the same time, when it comes to indigenous plants with health-healing qualities there's no substitute for going to the source of this knowledge—the nation's traditional healers. Their knowledge is critical to success. Otherwise, we would be searching for potential remedies in endless fields filled with seeds and stems."

"When the process is successful," Urverg-Ratsimamanga notes, "all of the participants benefit. The pharmaceutical company generates handsome profits from the sale of the drug. The institute receives a steady stream of funds that enable it to continue its efforts to find other medicinal plants, and traditional healers share in the royalties, which is a boon both to them and the village people they serve."

The institute, which now has a permanent staff of about 30, does more than search for and develop drugs. It also sells the drugs it creates at subsidized prices to local populations, which allow them to enjoy the same health-care benefits as citizens residing beyond Madagascar's borders; it manages a health clinic, which gives low-cost health-care to nearby residents; it oversees a botanical garden to help preserve the rich biodiversity that the region enjoys; it operates a small production facility that manufactures a variety of drugs for local distribution, including medicines to combat malaria, hepatitis and asthma; it organizes workshops and training programs for promising young scientists from Madagascar and neighbouring African nations; and it provides job opportunities to local residents in several different fields, both manual and technical, in a region where steady employment is hard to find.

In fact, one of the institute's first ventures, launched in the late 1950s, was to train indigenous people in the ancient art of silk worm breeding. The institute has since become a regional center of silk production, which has helped to boost local incomes while preserving local customs.

"From the start, the institute has been designed to produce a multitude of benefits," notes Rakoto-Ratsimamanga. "Our primary goal has been to use Madagascar's natural bounty and the tradi-

tional knowledge of its people to improve the public health of both local residents and citizens round the world."

"Revenues generated through our licensing agreements with Northern pharmaceutical firms, however, have given us the means to extend our goals beyond public health concerns to issues related to the environment and economic development. Our greatest satisfaction is derived from watching all of these elements work together." To date, the institute has successfully spurred the development of some 40 drugs derived from nearby indigenous plants. These efforts have provided the core of its funding.

As for its most recent efforts to develop an antidiabetic drug from the seeds of Madagascar's native Eugenia jambolana plant, Urverg-Ratsimamanga notes that the institute's research efforts are far from complete. "For insulin dependent diabetics, mostly children under 10," she cautions, "the drug, even if successfully brought to market, may not be of much help." These diabetics, who suffer from what medical experts call type-I diabetes, are incapable of producing any insulin at all. As a result, they must endure daily doses of insulin usually through injections and, at the same time, follow strict diets if they are to avoid the adverse health affects associated with hyperglycaemia or low blood sugar.

Urverg-Ratsimamanga goes on to say, however, that "our trials and testing of Eugenia jambolana's active agents have shown that our plant-related therapies have positive impacts on patients suffering from type-II or non-insulin dependent diabetes, which represents 90 percent of all cases of the disease worldwide." These patients, mostly overweight adults older than 40, have impaired pancreases that can no longer produce insulin at the levels their bodies need to ensure complete heath.

"Our investigations show that the active agents found in Eugenia jambolana don't enable patients to produce more insulin. Instead, the agents create a mechanism, which we still don't fully understand, that allows the body to more effectively absorb and utilize the reduced levels of insulin that are still being produced." In other words, the active agents of Eugenia jambolana, now being processed in the drug Madaglucyl®, allows diabetics to do more with less and thus helps them lead healthier lives.

The results of the clinical tests conducted by the institute have been impressive. For example, 75 type-II diabetic patients of normal weight were recently administered this plant therapy on a trial basis. Blood sugar levels fell nearly 50 percent in 70 percent of the cases after three months of therapy. In a similar test among 29 type-II diabetic patients, who were also suffering from obesity, average blood sugar levels fell by comparable percentages over a similar period. And even in a recent test among 24 type-I insulin-dependent patients, treatments using Madaglucyl® have displayed some promising results: average blood sugar levels were cut by 40 percent and daily insulin doses reduced by a third over a six-month period.

"These results are by no means definitive," Urverg-Ratsimamanga observes, "and we must continue our testing to ensure that the plant's medicinal values do not carry unanticipated side effects that would create their own set of health problems. Meanwhile, we will work with the pharmaceutical firm with which we have joined forces to explore ways to mass manufacture Madaglucyl® in a cost effective manner. We are encouraged by our initial efforts, but we still must overcome a host of obstacles—both scientific and administrative—before we can claim success."

Yet, given the institute's successful track record and the tireless dedication that the Ratsimamangas have shown through their 30-year partnership, no one is betting against them.

And this is one high risk operation where all observers agree that the potential payoff stands to benefit everyone—from corporate shareholders in large pharmaceutical firms to the anonymous men and women living in remote Malagasy villages far from the world of wheeling and dealing that often characterizes today's billion U.S. dollar global drug industry.

It's a credit to the Ratsimamangas' skills that they can live successfully in both worlds. And because of their success, hundreds of thousands—indeed millions—of people, often continents and cultures apart, are enjoying longer, healthier and happier lives. ■

SCIENCE: NORTH AND SOUTH

Italian-born Maurizio Iaccarino (TWAS Associate Fellow, 1997), a biochemist and bacterial geneticist by training, is currently the Assistant Director-General for Science at the United Nations Educational, Scientific and Cultural Organization (UNESCO), a post he has held for the past two and a half years. In that capacity, Iaccarino is the UNESCO official responsible for overseeing TWAS activities. He also is serving as UNESCO's principal organizer for the upcoming World Conference on Science scheduled to take place in Budapest early this summer. In December, at the Academy's 10th General Meeting, Iaccarino sat down with the editor of TWAS to discuss a wide range of issues, including the role of science at UNESCO, the importance of TWAS to scientists in the Third World, and the goals of the Budapest conference. Edited excerpts of their 90-minute conversation follow.

What is the role of science within UNESCO?

UNESCO is an intergovernmental organization with a mandate to promote a variety of activities, including science. What is important to emphasize is UNESCO's intergovernmental nature. Simply put, this means that whenever the governments of our members states agree to pursue a scientific initiative with the assistance of UNESCO, we are mandated to take action.

Some scientists, unfortunately, often have a misconception of UNESCO. Their well-being usually requires them to continually search for support for their research, and they see UNESCO as a funding agency. But that's not the organization's primary role. UNESCO's mandate is expressed only through the agreed-upon needs of its member nations and not the individual needs of scientists. Of course, scientific research often takes place through the auspices of government. As a result, UNESCO, working through the governments of its member states, is in continual contact with scientists.

Take, for example, the creation of CERN, the European Laboratory for Particle Physics. Some 45 years ago, European physicists sought to establish a particle physics laboratory in Europe. To advance their goal, they needed to interact with governments. So, they came to UNESCO to forge the intergovernmental relationships that were necessary to turn their vision into a reality. CERN, in fact, was founded at UNESCO. That's where all the European governments came to sign the agreement. Today, if a government wants to join CERN, it must come to UNESCO, and if it wants to leave CERN, it also must come to UNESCO. The same process is now unfolding among molecular biologists in Latin America. They have asked UNESCO to facilitate their efforts to create an international organization in Latin America dedicated to the advancement of molecular biology.

UNESCO's primary function, in brief, is not to do research, or even to directly fund research,

but to help coordinate the research agendas of member states. That's what our role was during the creation of CERN; that's the role we have played in the Man and Biosphere Program, which focuses on national parks and nature reserves; and that's the role we hope to play for molecular biologists in Latin America.

Where do small projects fit into UNESCO's overall mandate?

UNESCO is unique within the United Nations system in this way: Each nation belonging to UNESCO not only appoints an Ambassador, who is responsible for conveying the views of his or her government, but also members of a National Commission, who serve as an advisory board communicating their viewpoints both to officials from UNESCO and their own governments. The head of each commission is usually a minister, but the membership consists of well-respected academicians, researchers and artists from the worlds of education, science and culture. Then there are individuals who come to us wanting to do something interesting. If we believe the proposal has potential and is compatible with our mandate, we often find a way to make it happen.

For example, Angelo Azzi, a professor of biology from the University of Berne in Switzerland, came to us about 10 years ago to propose the development of a network of institutes in molecular biology in the South. This effort, which now consists of about 80 research centers throughout the world, is called the Molecular Cell Biology Network of UNESCO. With our help, the network promotes collaboration among its members institutions. Moreover, the network recently proved instrumental in launching a new molecular cell institute in Poland. The network's prestige, combined with an US$80,000 grant from UNESCO, spurred a large investment from the Polish government to build and equip the institute. The Polish government also agreed to provide a yearly budget to cover annual operational expenses. Similar trends are unfolding among other nations—Kenya, for instance, hopes to establish its own molecular biology institute with the help of the network. As these examples suggest, the network's association with UNESCO gives its members a level of credibility that they can sometimes parley into financial support from their governments.

Where does the Third World Academy of Sciences (TWAS) fit within the UNESCO framework?

TWAS is an extra-budgetary project within UNESCO's Science Sector—just like the Abdus Salam International Centre for Theoretical Physics (ICTP). Such projects usually begin when a government comes to us and says it would like to do something in a particular field—and that it would like to pursue this initiative through a cooperative arrangement with UNESCO. If we agree, we do everything we can, within our mandate and limited budget, to help the initiative succeed. For example, in TWAS's case, we give it very little financial sup-

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port, but we do assume responsibility for its administration and personnel. And, as I discussed above in terms of our other initiatives, TWAS's affiliation with UNESCO helps give the Academy credibility, which it can then use to attract other sources of funding.

TWAS is a marvelous organization. Scientists who have been selected as members are proud to be part of the Academy. And those who are not members are eager to join one of the most important organizations promoting the interests of science in the South. Indeed the role that TWAS plays in helping scientists from the South is significant.

For more than a millennium, the definition of science has been set by strict cultural boundaries. When we talk about modern science we usually mean the sciences that were invented by Western civilization. For this reason, science has come to be viewed as a product of Western culture. Modern science, in effect, began when Galileo and then Newton established a philosophy of science based on two unyielding factors: a reliance on the experimental method to study nature and on mathematics to verify data. Science, moreover, is a cumulative process. Galileo and Newton studied the celestial movement of planets in the 1600s. Some 300 years later, their 20th century counterparts used the laws that they had discovered to launch a satellite into orbit. The enduring truth is that you cannot lift a satellite into orbit today without relying on the laws of nature first articulated by Galileo and Newton.

Much of the scientific knowledge we have accumulated over the past 300 years has its roots in Europe. Still, much of humankind's earliest scientific and mathematical knowledge was created in India and China and elaborated and transferred to Europe through the Arab countries.

If you go to developing countries today, they say that they are very concerned about science. Their primary concern, however, is technology. They want televisions, cars, airplanes and the like. Science has become somewhat extraneous to their civilizations—despite the important role many of these countries played in the origins of science and despite the centers of scientific excellence scattered throughout the South today.

The problem is that you cannot use technology without a certain amount of science and that you cannot develop science without knowing science. And that's where TWAS becomes so vital: it instills a sense of pride and purpose among scientists working in the developing world while, through its programs and presence, it continually emphasizes the intricate links that exist between science and technology. Moreover, TWAS provides opportunities for scientists from the developing world to continually grow and remain productive within their fields of expertise.

At the same time, the developed world should welcome the creativity and intelligence of their fellow citizens from the developing world, who constitute 75 percent of the world's population. We not only have an ethical duty to promote the developing world's scientific and technological skills but it is in our self-interest to do so. We want not one but 1,000 Abdus Salam's, and the only way to help realize this dream is through our support for edu-

cation. That explains, in part, why Italy has agreed to provide the bulk of funding for the Academy since its inception and now has taken important steps to ensure a permanent funding base for TWAS.

Let's turn to the World Conference on Science to be held in Budapest this spring. Why did UNESCO launch the project and what does it hope to accomplish?

Some five years ago, at UNESCO's General Conference, the Director-General proposed the organization of a world conference on science. Some member states were critical of the idea, but they did not reject it. So we continued to discuss the proposal at UNESCO's Executive Board, which consists of representatives from 58 members states elected by all of UNESCO's 186 member states. The Board's advice was this: first, that we should collaborate with social scientists, and second that we should organize the conference together with the International Council for Science (ICSU). They then gave us the go-ahead and we have been busy preparing for the event ever since.

On the one hand, science has been the source of many of our most significant inventions driving progress. On the other hand, scientific progress has also been the source of many of our problems. Take, for example, the discovery and use of antibiotics. Who would question the invaluable contribution this has made to human welfare? Yet, by lengthening the average lifespan of people, antibiotics are also a prime cause of the explosive population growth we have experienced over the past century or so. And rapid population growth is the prime factor behind global pollution problems, including the degradation of our atmosphere and water, loss of farmland, depletion of our forests and spread of deserts. Indeed virtually all of our global environmental problems are a consequence of the fact that the earth is now home to 6 billion people.

At the World Conference on Science, we would like to discuss science's relationship with society—both for better and worse. Specifically, we hope to launch a dialogue between science and society in which there is realistic assessment of the kinds of things that science has done for and to society. We wish to explore the complexity of the world in which we live and in the process help all parties—the public, decision makers and even scientists—gain a greater appreciation for the risks that we face and how we may use science to better manage and mitigate them.

That's why ICSU is co-organizing the conference with us. This will enable us to bring scientists affiliated with ICSU together with government officials invited through the auspices of UNESCO's member states. And that's why we have invited several other organizations, including TWAS, to serve as what we call "privileged partners." Such partners will play instrumental roles in defining the issues and putting together the sessions.

We all have a challenging assignment, but we hope that the conference will mark a new beginning for what promises to be one of the most critical issues of the next century—the role of science in society. ■

TWAS COUNCIL (1999-2000)

PRESIDENT

• **José I. Vargas** (Brazil) has been re-elected president of TWAS, a position he has held since 1995. He recently stepped down as Brazil's minister of science and technology, where he had served since 1992. He is currently a special advisor to the president of Brazil on science and technology *(see picture below)*.

PRESIDENT-ELECT

• **C.N.R. Rao** (India), professor and president of Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India, is India's most prominent native-resident scientist and one of the world's leading experts on solid state science. He has served as TWAS vice-president for 7 years (*see picture next page*).

VICE-PRESIDENTS

• *Africa:* **G.O.P. Obasi** (Nigeria) has been secretary-general of the World Meteorological Organization (WMO) since 1984. A graduate of the Massachusetts Institute of Technology, he is internationally renowned for his research in meteorology and hydrology. This will mark Obasi's first term on the Council.

• *Arab Region:* **A. Badran** (Jordan) is currently president of Philadelphia University in Sweileh, Jordan. He served as Jordan's minister of education from 1989 to 1990 and until recently was UNESCO's deputy director-general. Prior to his election as vice-president, he was the Academy's secretary general.

• *Central and South Asia:* ***M. Akhtar*** (Pakistan) is professor of biochemistry at the University of Southampton in England. Although professionally based in the United Kingdom, he has maintained close ties to scientific communities in Pakistan and other developing countries. He was the Academy treasurer from 1992 to 1998.

• *East and Southeast Asia:* ***Y.X. Lu*** (China) has been the president of the Chinese Academy of Sciences, one of the world's largest science academies, since 1997. His main fields of interest are fluid power transmission and computer engineering applications. This will mark Lu's first term on the Council.

• *Latin America and Caribbean:* **M. Peimbert** (Mexico), professor of astrophysics at the Autonomous National University of Mexico, has served as a member of the Council since 1997. His research has brought new insights and precision to the measurement of gaseous elements in our galaxy and elsewhere in the universe.

SECRETARY GENERAL

• **M.H.A. Hassan** (Sudan), TWAS executive director (formerly executive secretary) since the Academy's inception, was elected an Academy Fellow in 1985. Trained as a theoretical plasma physicist, his research interests have focused on the physics of wind erosion and sand transport.

TREASURER

• **A.A. Al-Shamlan** (Kuwait), director general of the Kuwait Foundation for the Advancement of Sciences since 1985, has served as an Academy vice-president since 1992. From 1988 to 1992, he was Kuwait's minister of higher education. His prime research areas include petrographic analyses and tectonics.

COUNCIL MEMBERS

• **A.J. Arvia** (Argentina) is professor emeritus at the Physical Chemistry Research Institute in La Plata, Argentina, where he served as director from 1976 to 1994. A recipient of many international honors and a member of several national and international learned societies, he has been a Council member since 1996.

• **F. El-Baz** (Egypt) has been director of the Center for Remote Sensing at Boston University in the United States for more than a decade. A Council member since 1997, he has won numerous international awards for his pioneering work in topics ranging from applications of space photography to studies of desert terrain.

• **M.S. Jhon** (Korea, Rep.) has served as a member of the Council since 1997. Director of the Center for Molecular Science of the Korea Advanced Institute of Science and Technology since 1990, he is also a member of the Presidential Council for Science and Technology in Korea. Since 1997, he has been president of the Korean Association for the Advancement of Sciences.

• **L.P. Makhubu** (Swaziland) is professor of Chemistry at the University of Swaziland, where she served as vice-chancellor from 1988 to 1995. She has been president of the Third World Organization for Women in Science (TWOWS) since 1989. Among her research interests are the study of medicinal plants of Swaziland.

• **G.C. Lalor** (Jamaica) will join the Council for the first time. Since 1969, he has been professor of chemistry at the University of the West Indies in Jamaica, where he has served as pro-vice-chancellor since 1974. In addition, he is the director of the Center for Nuclear Sciences.

PEOPLE, PLACES, EVENTS

CARDOSO RE-ELECTED

TWAS Fellow (1984) Fernando Henrique Cardoso has been re-elected President of Brazil. Cardoso received more than 50 percent of the vote on the first ballot, which was held on 4 October, and thus avoided the need for a run-off election. According to election commentators, Cardoso's popularity stemmed from the success that his administration had in curbing inflation, which dropped precipitously from 2400 percent when he assumed office in 1994 to virtually zero at the time of the election. The global crisis, which began in Asia in the summer 1997 and has since spread to Russia and Latin America, will pose a major challenge for Cardoso during his second term, as he seeks to stem the precipitous decline in the value of Brazil's currency, the Real, and the rapid flight of foreign capital from his country. Rio de Janeiro served as the site of TWAS's Sixth General Conference, which took place in September 1997. Cardoso delivered the conference's opening address, in which he stressed the importance of both primary and secondary education in the advancement of science and technology, especially in the developing world. Cardoso, who holds a Ph.D. in sociology from the University of São Paulo, has published more than 20 books and hundreds of academic and popular articles.

C.N.R. RAO HONORED

TWAS Founding Member and President Elect, Chintamani Nagesa Ramachandra (C.N.R.) Rao, Albert Einstein Professor and President of the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India, has been elected an honorary member of the Japan Academy. The Academy is a select group consisting of just 70 scientists from around the world. Rao, who was chosen for his contributions to chemistry and advanced materials, is the first Indian scientist to receive this prestigious honor. Educated at the University of Mysore and Banaras Hindu University in India and Purdue University in the United States, Rao has enjoyed a long and distinguished career. He is a past president of the Indian National Science Academy; Indian Academy of Sciences; Indian Science Congress Association; and International Union of Pure and Applied Chemistry. In addition, he has served as Director of the Indian Institute of Science and is a member of the General Council of the International Council for Science (ICSU). He is also a Fellow of the Indian Academy of Sciences, a member of the Royal Society in London, and a Foreign or Honorary Member of the U.S. National Academy of Sciences, Russian Aca-demy of Sciences, Polish Academy of Sciences and American Academy of Arts and Sciences. Rao's major fields of interest are solid state chemistry, superconductivity, surface science, spectroscopy and molecular structure.

CARIBBEAN CONFERENCE

The first major Caribbean conference on science and technology was held in Trinidad and Tobago between 23 and 28 September. The conference, entitled "Furthering Cooperation in Science and Technology for Caribbean Development," was co-organized by the Caribbean Academy of Sciences, American Association for the Advancement of Science, United Nations Educational, Science and Cultural Organization and Association of Caribbean States. Participants focused on three major themes: regional issues related to science and technology; research priorities and strategies for addressing these issues; and opportunities for greater inter-regional cooperation. Specific topics under discussion included improving natural resource use and management; enhancing public understanding of science; and pursuing initiatives designed to tie scientific research more closely to efforts to alleviate poverty. The conference also served as the centerpiece of celebrations honoring the 10th anniversary of the Caribbean Academy of Sciences. On 28 September, as part of the conference's broad-ranging activities, TWAS Founding Fellow M.G.K. Menon presented a public lecture called "Science and the Human Condition."

PEOPLE, PLACES, EVENTS

NEW ARRANGEMENT

TWAS has signed a new "arrangement" with the UNESCO Sub-Regional Office for Science and Technology for the Southern African Development Community Countries (SDAC), headquartered in Pretoria, South Africa. The arrangement calls for "strengthening cooperation" between the two organizations for the "purpose of furthering the development of science and technology in the Third World." Among the activities TWAS and SDAC hope to pursue in the future are joint scientific workshops, meetings and symposia in SDAC member countries, increased support for young scientists and the exchange of scientific information and publications of mutual interest. As a first step in this emerging partnership, SDAC has agreed to provide travel support to help women scientists from southern Africa attend the Second General Meeting of the Third World Organization of Women (TWOWS) scheduled to take place in Cape Town, South Africa between 8-11 February 1999.

MAKHUBU ON PROSPECTING

TWAS Fellow (1988) and TWOWS President Lydia Makhubu recently published an essay in Science focusing on Africa's critical role in efforts to successfully implement the Convention on Biological Diversity, which was signed during the Rio de Janeiro Earth Summit in 1992. Makhubu is Vice Chancellor and Professor of Chemistry at Swaziland University. "Effective implementation of the convention," she notes, "will depend on the availability of national and regional capacities to interpret and apply the convention's provisions and apply them to specific situations." That, in turn, will require Africa's traditional medical practitioners to become more involved in the implementation of the convention's provisions. Makhubu notes that "the complexity of the African situation requires diverse input and expertise to understand the sociocultural circumstances and merge them with scientific requirements associated with international demands for bioprospecting." She goes on to say that both the North and South share a common responsibility to "exercise stewardship over diverse biological resources so that future generations may receive their rightful inheritance. The African tradition," she concludes, "can complement modern scientific approaches in this aim." For the complete text of Makhubu's article, see Science 282 (2 October 1998).

This fall, Makhubu also learned that she was the recipient of the Comenius Medal, which is bestowed jointly by UNESCO and the Czech Republic's Ministry of National Education, Youth and Sport. The award was first given in 1992 in honor of the 400th anniversary of the birth of Czech-born Jan Amos Comenius (1592-1670), a noted Renaissance thinker. It is granted to individuals who have made significant contributions in the fields of teaching and educational research. The ceremony took place at UNESCO's headquarters in Paris.

NASIM A FELLOW

Anwar Nasim (TWAS Fellow 1987) has been elected a Fellow of the Islamic Academy of Sciences. The induction ceremony will take place this spring. Nasim, who was educated at universities in Pakistan and Canada, is currently the science advisor for COMSTECH, the ministerial standing committee on science and technology for the Organization of Islamic Conference (OIC). He also is a member of the International Advisory Committee of the National Institute for Biotechnology and Genetic Engi-neering in Faisalabad, Pakistan, and a honorary professor at the H.E.J. Research Institute of Chemistry of the University in Karachi, Pakistan. He has been a visiting scientist at research centers in Canada, Germany, the United States, and Saudi Arabia. His major research interests include molecular genetics and environmental mutagenesis.

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