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YEAR 2000
JAN-MAR
VOL.12 NO.1



TWAS newsletter

THE NEWSLETTER OF THE THIRD WORLD ACADEMY OF SCIENCES



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

The Third World Academy of Sciences (TWAS) has received the Group of 77/United Nations Development Programme (UNDP) award for economic and technical co-operation among developing countries for the year 1999. The joint announcement was made by G-77 Chairperson Arthur C.I. Mbanefo, who serves as Nigeria's Minister of Foreign Affairs, and UNDP Administrator, Mark Malloch Brown, at the "hand-over ceremony of the chairmanship of the G-77" from Guyana to Nigeria that took place in New York City 13 January 2000.

TWAS Honoured

The G-77/UNDP award, which was launched in 1994, is given to institutions that have made significant contributions to the promotion of South-South cooperation. Previous recipients include the South Centre, the Third World Network, the South-North Development Monitor, and Eduardo Praslj, Chairperson of the Perez-Guerrero Trust Fund for Economic and Technical Cooperation among Developing Countries.

UNDP is the largest source of assistance for development and the main body for co-ordinating the UN's development work. The G-77, with 133 members, is the largest coalition of third world countries in the UN. G-77's goal is to advance the developing world's economic interests and to enhance its negotiating capacity on international economic issues within the UN system. It also seeks to promote technical and economic co-operation among developing nations.

TWAS recently worked with UNDP's Special Unit for Technical Cooperation among Developing Countries (SU/TCDC) on the "sharing innovative experiences" project, which resulted in the publication of a monograph highlighting more than 25 examples of successful initiatives in the use of science and technology in the developing world. The case studies ranged from improvements in the design and efficiency of broad-bed ploughs in Ethiopia to the creation of a thriving airline manufacturing enterprise in Brazil. TWAS has also worked closely with the G-77, most recently as an active participant in workshops leading up to the first G-77 Summit to be held in Havana, Cuba, this April.

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TWAS NEWSLETTER

PUBLISHED QUARTERLY WITH
THE SUPPORT OF THE KUWAIT
FOUNDATION FOR THE
ADVANCEMENT OF SCIENCES (KFAS)
BY THE THIRD WORLD
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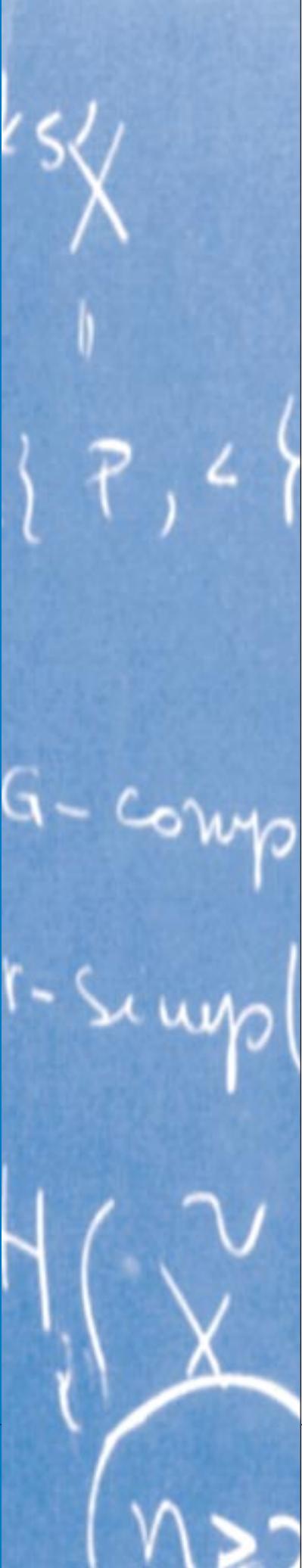
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TWAS is indeed honoured to be the most recent recipient of the G-77/UNDP award. We are particularly delighted to note that this marks the first time that the award has been given to a scientific organization — another encouraging sign of the increasing role that science and technology are playing in efforts to promote economic development throughout the developing world.



TWAS has modified the design of its newsletter in response to encouraging and helpful comments received from our readers. We have tried to retain the appealing elements of the previous format — the magazine-like look; the use of text as a design element; and the sprinkling of graphic symbols, photos and clip art. At the same time, we have increased the point size of the lettering and reduced the amount of italicized print to ease readability. As for the content, it remains largely unchanged — a mix of news articles, features, profiles and announcements designed to keep readers up-to-date on Academy activities while capturing the broad range of productive and interesting work being done by Academy members. We hope you are pleased with the results. Please don't hesitate to convey your comments and suggestions to twas@ictp.trieste.it.

SCIENCE AT DAVOS

Presidents of 14 of the world's most prestigious national scientific academies met earlier this year at the World Economic Forum (WEF) in Davos, Switzerland, to discuss the feasibility of creating an interacademy council that would provide expert advice to international organizations on critical issues of global concern.

Six of the 14 participating academy presidents were from developing countries, including the presidents of the African Academy of Sciences, Brazilian Academy of Sciences, Chinese Academy of Sciences, Indian Academy of Sciences, Mexican Academy of Sciences, and Academy of Sciences of South Africa. The president of the Third World Academy of Sciences (TWAS) was also invited to attend.

Given the balanced and authoritative research conducted by the International Council for Science (ICSU), Intergovernmental Panel on Climate Change (IPCC), Scientific Committee for the International Geosphere-Biosphere Programme (IGBP), Scientific

Committee on Problems of the Environment (SCOPE), and a host of other scientific organizations, do we need another international scientific advisory body feeding more information to decision makers who often complain about being over-stuffed with information?

Proponents of the interacademy council make their case this way: "The council would help fill an unmet need for consistent, sound scientific advice on an increasingly large number of complex, often politically charged, global issues which require independence of scientific judgement and credibility with the public." The council, they maintain, would not duplicate the efforts of other long-standing scientific bodies but complement their work by providing information, upon request, to such bodies as the UN General Assembly or such UN agencies as the UN Development Programme and UN Environment Programme, the World Health Organization and the World Bank.

Participants at the Davos meet-

ing, which was spearheaded by the US National Academy of Sciences, agreed to a tentative administrative framework for the council. The organization would be created as a legal entity associated with the Inter-Academy Panel (IAP) — an informal network of the world's science academies launched in 1995 to encourage academies to work together on scientific aspects of issues of international concern. The council's day-to-day activities would be directed by a small secretariat, likely to be located in a European city. A board, consisting of representatives from 15 national science academies, would approve the council's projects and appoint reviewers who would be responsible for evaluating the quality of analysis found in the report and determining whether the report fulfilled the project's original objectives.

The council's work, participants concurred, would not be open-ended. Instead, it would take place on a project-by-project basis depending on specific re-

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quests made by international organizations and the ability to secure adequate funding for the effort.

The meeting at Davos marked an important step forward for the creation of an interacademy council similar to the one outlined above. In light of the progress made in Switzerland, it now seems likely that such a council will be created in the near future.

Participants at the Davos meeting appointed a constitutional committee consisting of the presidents of the Brazilian, French, German and Indian scientific academies and called upon them to recommend, among other things, the general criteria for project approval and overall project oversight, as well as the goals and initial composition of the council's board. Those recommendations will be presented to the Steering Committee of the IAP during its international conference scheduled to take place this May in Tokyo.

At the same time, participants at Davos identified 10 major chal-

lenges in the 21st century for which valid, independent scientific advice is likely to be crucial. Among the challenges cited were bridging the information gap between rich and poor; improving the capacity of societies to use knowledge; preventing infectious and chronic disease; using science to address the needs of the poor; and mitigating the effects of natural disasters — issues of critical importance for the future well-being of the developing world.

We will keep you informed of developments concerning the interacademy council as the organization's structure and activities come into sharper focus in the months ahead. ■

◆◆◆ *Mohamed H.A. Hassan*

Executive Director

Third World Academy of Sciences

President

African Academy of Sciences



L'ORÉAL AWARD WINNER

ECUADORIAN SCIENTIST AND TWAS FELLOW GARNERS PRESTIGIOUS AWARD
FOR HER NOTEWORTHY ACCOMPLISHMENTS IN THE CLASSROOM,
LABORATORY, FIELD AND POLITICAL ARENA.



Teacher. Researcher. Conservationist. Throughout her career, TWAS member (1989) Eugenia M. del Pino has achieved success in each of these endeavours.

For her efforts, this past January del Pino became one of five women scientists — one from each of the five continents — to be honoured with a L'Oréal Awards for Women in Science, which receives support from L'Oréal and the United Nations Educational, Scientific and Cultural Organization (UNESCO). TWAS member (1998) Gloria Montenegro, professor of botany at Pontifical Catholic University of Chile, was a previous prize winner.

The award, which in 2000 was given to women scientists working in the life sciences, carries a US\$20,000 cash prize. It represents a key component of the UNESCO/L'Oréal "For Women in Science" initiative. The purpose of the overall initiative is to "promote the role of women in science and technology."

del Pino's work life was set to begin in the late 1960s after her graduation from the Pontifical Catholic University of Ecuador in Quito, where she pursued courses to become a biology high school teacher. But her career path took an unexpected turn North when she learned that she had been chosen to participate in the Latin American Scholarship Program of American Universities (LASPAU). The programme provides advanced training to young students who agree to return to their home countries after completing their studies abroad. The goal is to strengthen the teaching and research skills of instructors in Latin American universities.

del Pino jumped at this unexpected opportunity but in characteristic fashion she also sought to maximize the benefits that this once-in-a-lifetime chance offered. As she recently recalled, "I successfully persuaded officials from LASPAU that to be a good teacher of science I needed to obtain a doctorate degree." In response to





her concerns, her initial programme was expanded with additional funding from the American Association of University Women (AAUW). As a result, del Pino received her master's degree in science from Vassar College in Poughkeepsie, New York, in 1969, and her doctorate degree in developmental biology from Emory University in Atlanta, Georgia, in 1972.

"I was fortunate enough to attend elite universities in the United States for my advanced degrees," del Pino notes. "But I was determined to fulfil the moral commitment that I had agreed to when I accepted the fellowship and not to become another 'brain drain' statistic. Having an opportunity to study in world-class US universities made me even more eager to come back home where I would be in a better position to help others. I also thought it would be easier to climb the aca-

*The UNESCO/L'Oréal
"for women in science"
initiative promotes
"the role of women in
science and technology."*

demical ladder in Ecuador where I would be more at ease with the culture and language than I would ever be in the United States."

She adds that when she returned home in 1972 "oil was selling at US\$40 a barrel. The revenues generated by petroleum exports allowed Ecuador to make significant strides in education and research. As a pioneer in science at my university, it was both rewarding and exciting to be part of this growth spurt."

del Pino was hired as a full professor at the Pontifical Catholic University in September 1972 at the age of 27. At the time, she was the only professor with a doctorate in the biology department. The same year, she became department head when the head resigned.

"I remained in this position for only two years," she recalls. This brief experience, however, proved invaluable to her career — for the administrative



skills she acquired, the high-level contacts she nurtured and, above all, for the ability it gave her to set long-term research goals for herself and her department. "By virtue of my position," she notes, "I was able to make critical decisions concerning both my personal future and the future of my department. I knew that I wanted to concentrate on research and I believed that the department could make a mark in science by focusing on issues related to biodiversity."

During her brief tenure as department head, the director of Darwin Research Station in the Galapagos Islands, which is part of the Charles Darwin Foundation, asked del Pino if she would be interested in having students conduct thesis-related field work.

The Galapagos Islands are hallow ground in the field of biology. It was in this pristine isolated environment that Darwin did critical field work leading to his classic theory of evolution. del Pino quickly accepted the offer, marking the beginning of a long-term rela-

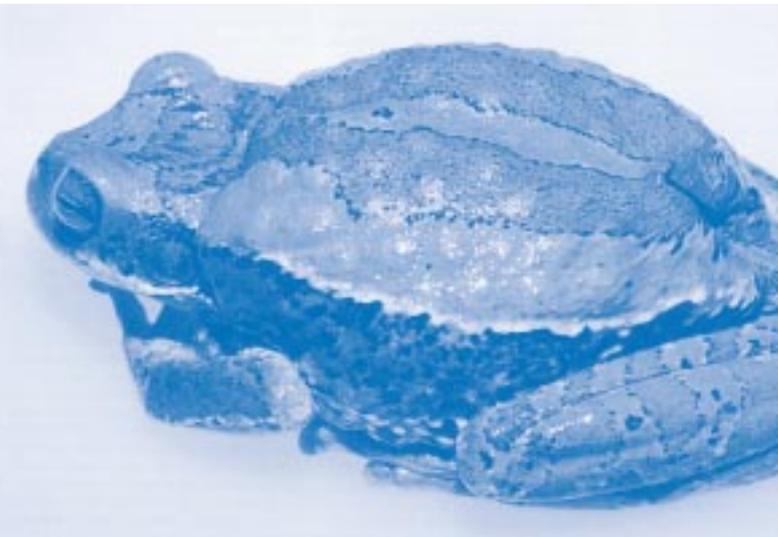
del Pino was hired as a full professor at the Pontifical Catholic University in September 1972 at the age of 27.

tionship with the Charles Darwin Foundation that was to have a profound effect on both her career and Ecuador's scientific community.

"Many of the nation's environmental leaders, not only in Ecuador but throughout Latin America, have received their initial education and training at the Pontifical Catholic University/Darwin Foundation's joint programme in the Galapagos Islands," del Pino says. "The programme, along with my teaching assignments at the university, has allowed me to share my knowledge and enthusiasm with many students over the past three decades."

Her association with the Charles Darwin Foundation has also helped launch and sustain her career as a conservationist. del Pino, who served as the foundation's vice-president for Ecuador from 1994 to 1996, is now vice-president for the foundation's general assembly.

"As Darwin showed the world," del Pino passionately notes, "the Galapagos Islands are a unique envi-





ronment. They are renown for their pristine beauty; they contain plants and animals that are found nowhere else on the Earth; and they served as the field laboratory for Darwin's theory of evolution, providing the data and inspiration for one of the most important theories in the history of science."

Today, the Galapagos Islands play a critical role as a "site indicator" often casting revealing light on some of the world's most critical environmental issues. The presence of large commercial fishing fleets, for example, has threatened the health — and perhaps long-term survival — of the island's coastal fisheries. In addition, increased tourism and rising population have placed unprecedented pressure on the island's fragile ecosystems.

"The Galapagos Islands," del Pino notes, "are located in the Pacific Ocean more than 1000 kilometres from Ecuador's main territory; in addition, the individual islands are not close to one another. If such an isolated place faces environmental threats, then those threats are likely to be even more acute in environments that are more accessible to humans — for example, Ecuador's Amazonian rain forests located on mainland."

The Darwin Foundation, which has sought science-based solutions to some of the area's most pressing problems, provides scientific and technical advice to the government of Ecuador. The government's national park service, which receives advice from the foundation, is directly responsible for the management of the Galapagos National Park.

"Success stories emerging from this collaboration," del Pino declares, "include the rearing of at-risk giant tortoises in captivity and the *in situ* protection of such endangered plants as *Calandrina* and *Scalesia*." For her conservation efforts, del Pino was awarded a diploma from the World Wildlife Fund in 1986 and a medal from the Charles Darwin Foundation on the occasion of the foundation's 40th anniversary in 1999.

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Of all del Pino's intersecting career tracks, none has been more important than her research. Here again, she has chosen a unique path that has allowed her to establish her own identity while building connections with the larger scientific world.

Her research has focused on the reproductive and developmental adaptations of the marsupial tree frog (*Gastrotheca riobambae*), which is found only in Ecuador. While the embryos of most frogs develop from eggs submerged in water, the embryos of marsupial tree frogs are incubated inside a pouch found on the back of terrestrial-bound mothers.

She explains her research interests in this way: "I chose the marsupial tree frog because it was easily accessible. Since little was known about the development of this and other marsupial frogs, I felt that I would not face direct competition from other researchers. And, since the terrestrial reproduction of these frogs is so different from other frogs, the topic was likely to prove interesting. All of these factors, I hoped, would allow me to make original contributions to science."

The reproductive physiology of the female marsupial tree frog, in fact, corresponds to that of mammals. As del Pino puts it, "this situation represents a parallel pattern, not a missing link in evolution. While certain aspects of development in marsupial tree frogs are frog-like, oth-



Of all del Pino's intersecting career tracks, none has been more important than her research.

ers are not. For example, frog eggs develop quickly, while embryos in mammals and marsupial frogs, which are protected inside the body of the mother, develop slowly."

del Pino's research and those of her colleagues have shown that there is no single "model organism" whose development fully explains the patterns of other organisms. Instead development is determined step-by-step through unique ecological and physiological adaptations that have evolved within each species.

As developmental biology has emerged as a "hot topic" in the biological sciences and model organisms



as a key point of inquiry, del Pino's research efforts have become central to the debate. Her efforts have led to publications in such international journals as *Scientific American*, *Nature* and *Development* and to a one-year fellowship from the Alexander von Humboldt Foundation to conduct research at the Cancer Research Centre in Heidelberg, Germany, where she became acquainted with molecular methodologies essential to her work. In addition, del Pino was elected to the Latin American Academy of Sciences in 1987 and the Third World Academy of Sciences in 1989. She remains the only scientist from Ecuador who is a member of TWAS.

She acknowledges that her career has benefited constantly from collaboration with international colleagues. She also notes that her commitment to science has not been compromised by competing commitments to family and children. And she admits that she has been fortunate to reside and work in a society where "women can pursue any career they choose." Nevertheless, she says that women scientists worldwide continue to face many challenges, including "underrepresentation in scientific disciplines and barriers to leadership positions."

del Pino doesn't intend to use her new-found notoriety as a recipient of a L'Oréal Award for Women in Science to become a staunch and vocal advocate for

women in science. She will let her success as a teacher, researcher and conservationist speak for itself.

Instead, del Pino will continue to devote her time to "seeking ways of encouraging students — young women and men alike — to become more interested in science." And, she will continue to speak out for the protection of our global environment and precious natural resources. "That's the best way I know to put my talents to work to help my society and my profession." ■

del Pino will devote her time to "seeking new ways of encouraging students to become more interested in science."

For more information about the L'Oréal Awards for Women in Science (with support from UNESCO), contact

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✦ Wassyla Tamzali
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+ 33 1 45 68 10 00.

Also visit the awards web site at

✦ www.forwomeninscience.com/awards/awards.asp.



TREASURE TROVES OF TRADITION

BORNEO'S TRADITIONAL PLANTS AND HOME-GROWN MEDICAL CURES
COULD HELP CONQUER SOME OF THE WORLD'S MOST TROUBLESOME DISEASES
— AND GENERATE MUCH NEEDED CAPITAL AS WELL.

by Fasihuddin B. Ahmad and Ghazally Ismail

Borneo is home to many ethnic groups, each of which maintains a unique way of life that often features the use of traditional cures and medicines.

Such traditions are not only bonded by culture but serve as effective alternatives or supplements to modern medicine. To date, research has shown that more than 1000 plant species in Borneo have medicinal value — that's just 10 percent of the total number of Borneo's plant species.

Through appropriate technology and systematic research, it's likely that new biologically active principles derived from these plants await discovery. In fact, driven by the challenges posed by such horrifying diseases as cancer and AIDS, many Northern laboratories and pharmaceutical companies have become increasingly interested in the potential value of traditional medicinal plants and practices.

In Borneo, the need for detailed systematic studies on the ethnobotany and ethnopharmacology of indigenous plants is urgent. Rapid destruction and disappearance of natural habitats caused by deforestation and other human activities have brought many medicinal plant species to the edge of extinction.

To counteract these ominous trends, the Universiti Malaysia Sarawak (UNIMAS) launched a project to compile and document medicinal plants used by Borneo's multiple ethnic groups. The primary goal is to ensure that traditional knowledge of medicinal plants and local health-care practices do not succumb to pressures imposed by modern beliefs and life-styles.

Rapid screening for the discovery of new drugs is another key element of the project. The latter has been a collaborative effort between UNIMAS and Yamanouchi Pharmaceutical Company in Japan. Known among scientists as "high-throughput screening," the technique is capable of screening more than 1 million samples a year.

To date, however, insufficient samples and unreliable supplies have rendered this technology too risky for investors. A partnership between a resource-rich country like Malaysia and a technology-rich nation like Japan could bridge the gap between this burgeoning technology and the capital that it needs to flourish.

A recent study by the World Health Organization (WHO) concludes that 80 percent of the world's population depends on traditional medicines to meet at least some of their primary health-care needs. Most of



Disappearance of natural habitats has brought many medicinal plant species to the edge of extinction.

these medicines are derived from plant extracts or active principles originating in parts of the plants. Meanwhile, other studies show that about 40 percent of modern medicines prescribed throughout the world are derived directly or indirectly from plants or animals. These medicines include such major life-saving drugs as reserpine, atropine, quabain, vinblastine and vincristine.

However, the medical benefits obtained from such plants may be short-lived. Equally worrisome, the ability to tap future benefits may never be fulfilled. Why? Destruction of such pristine natural habitats, notably tropical rain forests and marine ecosystems, continue to take place at unprecedented rates around the world, including Malaysia.

Destruction of tropical rain forests adversely impacts pharmaceuticals in two ways: it causes the disappearance of many medicinal plant species that researchers have yet to discover and catalogue, and it causes the displacement of the indigenous peoples who have the knowledge and wisdom to use these plants effectively.

Key aspects of the UNIMAS medicinal plant project include:

- Documentation of local medicinal plant uses before such indigenous knowledge is lost forever.
- Development of scientific evidence for plant extracts or active principles found effective in treating ailments or diseases.
- Examination of intellectual property rights to ensure equitable sharing of the financial rewards accompanying the discovery of a new drug.
- Identification and conservation of habitats harbouring the natural growth of medicinal plants to maintain their abundance *in situ*.
- Guidelines for medicinal plant research to help forge partnerships with developed countries that have advanced technological capabilities in drug discovery research.

A research programme directed at finding new drugs requires a highly integrated multidisciplinary approach.

The first step is to select plants worthy of additional study. Researchers can avail themselves of several methodologies when devising an investigative strate-



gy: random, taxonomic, chemotaxonomic or ethnobotanical plant selection are all possible.

UNIMAS adopted both random and ethnobotanical approaches with the ultimate goal of developing an extract bank for drug screening. An ethnobotanical approach is used in cases where indigenous knowledge on the effectiveness of a medicinal plant is well established in the scientific literature; random collections take place when there is a high level of scientific uncertainty concerning a plant's medicinal value. In the latter case, high-throughput screening is invaluable.

In-field investigations work like this: UNIMAS researchers visit remote ethnic communities throughout Borneo to interview medical practitioners and medicinal plant collectors. With the latter's help, plants are gathered from forests or herbal gardens often found nearby. In the laboratory, crude extracts are prepared from each plant sample to create a computerised extract bank in which thousands of crude fractions or active plant principles are kept for high-throughput screening. Plants demonstrating favourable bioactive activities are considered "hits" with the potential to serve as the basis of discovery for new drugs. Such "hits" are subject to in-depth investigations and bioassays designed to isolate and identify the active principles.

Analyses of the medicinal plants in Borneo used to treat various ailments and diseases reveal important

insights into the practice of traditional medicine in local communities. Different ethnic groups may turn to the same plant species to treat similar ailments. For instance, many ethnic groups use *Cassia alata* to treat ringworm and other skin diseases. That should not be surprising because medicinal plants may contain certain active principles that prove effective against particular ailments.

However, there are also instances in which different ethnic groups use different plant species to treat the same ailment. For example, the Brunei Malays use *Andrographis panicula* and *Musa paradisiaca* to treat malaria while the Dusun and Kadazan use

Phyllanthus niruri and *Physallis minima* and the Muruts use *Tinospora crispa*. Such diverse practices may be due to the availability of plants in the surrounding habitats. But what is significant from a scientific point of view is that different plant species may contain similar active principles.

To make matters more complicated, there are also cases in which different ethnic groups use the same plant species to treat different diseases. For example, the Dusun and Kadazan use *Jatropha curcus* to treat cuts, wounds and stomach-aches; the Idahan use the same plant to treat headaches. Similarly, the Murut use *Urena lobata* to treat influenza while the Bajaus use it to treat dysentery, and the Dusun and Kadazan use it to treat boils, coughs, fevers and stomach-aches. This

A recent WHO study concludes that 80% of the world's population depends on traditional medicines.

tells us that a plant species may contain several active principles, each effective against different ailments.

The UNIMAS research partnership with Japan's Yamanouchi Pharmaceutical Company is based on a memorandum of understanding that stipulates the tasks and responsibilities of each. The university shoulders responsibility for developing an extract bank based on the indigenous plant pool while the pharmaceutical company handles high-throughput screening using robotics-based technology in Japan.

Extracts obtained from Borneo's diverse biological resources are systematically coded before being made available for drug screening. This ensures that the identity of the source material remains the proprietary information of the research partner from the developing country until a mutual agreement is reached between the partners to investigate any "hits" or lead compounds discovered during screening.

Malaysian policy makers and research scientists greeted the arrangement with suspicion fearing that local medical practitioners and residents would lose out. Critics cited the experiences of other developing countries to highlight the often scandalous nature of such partnerships. For example, when the Elli Lily

Company's discovered and commercialised the anti-leukemia drug vinblastine from the periwinkle plant used for generations by the shamans in Madagascar, the company profited handsomely while the local community received little financial reward for the critical role it played in the project's success.

Such fears may be allayed by having both parties agree to specific conditions and procedures ensuring that proprietary knowledge on the drug's origins remains in the hands of the developing countries. The university's insistence that the thousands of extracts screened by our foreign partner are identified solely

as coded samples shows how such equitable arrangements may be put in place. It is just one example of how successful applications of traditional medicines and medical practices to combat today's diseases and ailments could be based on a true South-North partnership that benefits both parties while it improves public health on a global scale. ■

Successful applications of traditional medical practices should be based on a true South-North partnership.

❖ *Fasihuddin B. Ahmad and Ghazally Ismail are members of the Faculty of Resource Science and Technology at Universiti Malaysia Sarawak in Sarawak, Malaysia*



C.N.R. RAO IS SET TO BECOME THE ACADEMY'S THIRD PRESIDENT, FOLLOWING IN THE FOOTSTEPS OF ABDUS SALAM AND JOSÉ I. VARGAS. RAO INTENDS TO USE HIS SKILLS AS A RENOWNED SCIENTIST AND ADMINISTRATOR TO ADVANCE TWAS'S GOALS IN RESEARCH, TRAINING AND EDUCATION.

When C.N.R. Rao assumes the presidency of the Third World Academy of Sciences (TWAS) following the Academy's 12th General Meeting in Tehran, in October, he will bring with him a lifetime of commitment to the advancement of science in the developing world.

This commitment has been shaped by a distinguished roster of role models both within and outside the scientific community. The inspiration that he has drawn from these role models helps to explain his twin passions: his tireless desire to reveal the innermost structures of solids and molecules (in Rao's words, to uncover the "true elegance and beauty" of nature) and his uncompromising efforts to boost political and financial support for science throughout the developing world, particularly in his native country of India.

"Although I was interested in science at an early age," Rao noted in a recent interview with the editor of the *TWAS Newsletter*, "it was not until I was an undergraduate student

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at the University of Mysore in India during the late 1940s that I decided to become a scientist."

"An undergraduate professor of chemistry was responsible for transforming my vaguely formed personal interest into a laser-focused career goal. Although conducting little research on his own, the professor constantly spoke to us about the worthwhile personal and social values that could be promoted through scientific research."

"Two years after completing my undergraduate studies," Rao continues, "I had an opportunity to read Linus Pauling's *The Nature of the Chemical Bond*, a groundbreaking book in the field of chemistry. The sense of excitement and wonder that Pauling conveyed about the largely unexplored world of molecules and materials made me realize that I wanted to devote my career to exploring the fundamental principles of chemistry as a way of enhancing our understanding of the structure and behaviour of materials and molecules."

To acquire the knowledge and skills that he would need, Rao chose to pursue his doctorate degree in the United States. He left for Purdue University in Indiana, in America's heartland, in 1954 and completed his studies there in 1958. He went on for post-doctoral work at the University of California at Berkeley.

"I enjoyed my stay in the United States and learned a great deal through my studies there," Rao notes, "but I always knew that I wanted to return to India. My university edu-



education took place during the era of Indian independence and nation building, and I found myself inspired by the words and deeds of Mahatma Gandhi, Pandit Nehru and others who played key roles in the creation of the modern democratic state of India. I never forgot the thrill that I experienced when India became free in 1947, and I always felt that I had an obligation to contribute to the growth of an economically and scientifically strong India once I had received sufficient training to make a contribution.”

That’s why Rao turned down several attractive offers in the United States and returned to India in 1959. His goals, in his own words, were “to develop a research laboratory that would be as good as the best in the world and to publish quality scientific papers that would have an impact both at home and abroad.”

Rao has succeeded on both counts, but the path to his success was by no means easy. During his early years of struggle, the world-class chemistry laboratory he hoped to create often did not have electricity and water, and the world-class Indian scientists he hoped to hire often found greener research pastures in the United States and Europe, where they would journey not just to study but to stay.

Rao found a way to overcome these initial obstacles and to emerge as one of the world’s leading experts in the field of solid state and materials chemistry. His pioneering work in the study of phase transitions, surface phenomena, new carbon forms, porous solids and, most notably, transition metal oxides has both deepened and broadened our understanding of metal insulator transitions and high-temperature superconducting materials.

When he began his explorations in the late 1950s, few other researchers were pursuing these fields, opting instead to concentrate on more conventional areas of chemistry. Within the next two to three decades, however, the study of metal insulator transitions and high-temperature superconducting materials emerged as two of the hottest topics in science.

More recently, Rao has applied his talents to the burgeoning field of the chemical design of materials. Here he has sought not only to help improve our understanding of materials but to provide the know-how to create new ones. To date, Rao has more than 600 research publications and some 34 books to his credit, including such seminal works as *Phase Transition in Solids*, *New Directions in Solid State Chemistry*, *Chemical Approaches to the Synthesis of Inorganic Materials and Transition Metal Oxides*.

While energetically pursuing his own research agenda, Rao has found time to be a leading spokesperson for the promotion of science not just in India but throughout the developing world. As the president of the Jawaharlal Nehru Centre for Advanced Scientific Research, he has used his position in one of India’s most prominent research facilities to beseech governments in the South to devote more resources to scientific capacity building. He is often quick to note that investment in such endeavours is the only true pathway to sustainable development.

His voice in this ongoing struggle has been strengthened by his appointment to the executive board of the International Council for Science (ICSU) and his election to the pres-



idency of numerous institutions, including the Indian National Science Academy, Indian Academy of Sciences, Indian Institute of Science, and International Union of Pure and Applied Chemistry.

Rao acknowledges that developing countries — most notably, such “advanced” developing countries as Brazil, China and India — have made significant strides in improving their scientific capacities. The problem, according to Rao, is that scientific development among developed countries is moving ahead at an ever-faster pace. Such trends mean that the South could fall even farther behind the North, unless developing countries find the will and resources to invest even greater sums of money in basic and applied science, both now and in the future.

“While I am proud to be one of the pioneers in solid state and materials chemistry, my experience remains unique. Unfortunately, chemistry researchers in most developing countries have been unable to contribute to the frontiers of the profession. That’s not to say research doesn’t take place in these countries, but that education and training often remain bogged down in traditional fields of study. This problem is partly due to outdated equipment and partly to research and university systems that are slow to change their agendas to meet the challenges posed by new fields of inquiry.”

What’s true in chemistry is also true in biology, basic medical research, mathematics, computer science and physics. That’s why Rao has called on developing countries to provide additional funding for science and to radically transform their educational systems. Given the unprecedented advances in scientific knowledge now taking place, Rao maintains that research centres and universities must remain flexible if they hope to be engaged in cutting-edge scientific issues where the most intriguing and potentially most valuable discoveries take place.

“Unless research institutions and universities in the developing world are up-to-date on the latest information and advances in their fields,” Rao asserts, “it will be hard for them to compete and contribute to the development of science and technology.”

Rao’s continual efforts to improve the state of science in India seem to be paying dividends. *Science*, for example, recently pointed to Rao’s urgent requests for India to double

funding levels for both education and science as a key factor in Prime Minister Atal Behari Vajpayee's announcement that his government would raise spending for research and development to 1 percent of India's gross domestic product (GDP) in 2000 and 2 percent of GDP by 2005. In real terms, that means the amount of money devoted to R&D will jump from US\$2.5 billion in 1999 to US\$3.35 billion this year to US\$5 billion in 2005.

Rao's commitment to TWAS is no less vigorous than his commitment to science in India. As a founding member of the Academy, he proudly observes that TWAS has served as an invaluable forum for scientists from the South. "The main purpose of TWAS has been to instill pride and self-esteem among scientists from the South and to make them feel equal to the best in the world. The Academy has performed this task with distinction," he adds. "As a result, TWAS is recognized around the world as a powerful force in the transformation of developing societies through science."

As president, Rao plans to build on the Academy's success by concentrating on a few initiatives that he hopes "can bring about significant change to developing countries over the next five to ten years." For example, he would encourage TWAS to launch "a programme to train and assist 1000 to 2000 scientists in Africa in a variety of scientific fields. Similarly, if TWAS chooses to apply the talents of its membership on a topic of critical concern to the developing world — say, efforts to protect biodiversity or the quality of drinking water — it should only do so if it has reasonable expectation that such efforts will make a difference."

"Such initiatives will likely require us to work through South-South partnerships and, when necessary, South-North partnerships as well. Success will depend on bringing together a critical mass of expertise and resources to address the concern at hand. I believe that's the only way the Academy can make a difference over the long-term."

"TWAS," he says, "is in a unique position to help meet the challenges of science-based sustainable development. After all, we have members from both the North and the South and a long and successful track record of promoting South-South co-operation. As a result, there's no reason why we should not serve as a key participant in discussions and evaluations of critical global scientific issues."

Despite the importance he places on science and science-based development, Rao adds this cautionary note: "Science alone cannot progress unless an entire society progresses. A common characteristic of developing countries is poor infrastructure (in energy, transportation and communication) and poor educational systems. Unless developing countries have adequate communication systems, they will not be able to make use of advanced information technologies. And if they can't take advantage of such critical tools, it is unlikely that they will be able to close the science and technology gap with developed countries."

"Shortfalls in education," Rao concludes, "pose an even more critical challenge. Only by nurturing well educated, enthusiastic scientists and supportive, scientifically literate citizens will the developing world be able to attain technological and economic parity with the developed world."



TWAS AWARDS IN BASIC SCIENCES 1999

EACH YEAR, THE THIRD WORLD ACADEMY OF SCIENCES (TWAS) AWARDS FIVE US\$10,000 PRIZES TO SCIENTISTS FROM DEVELOPING COUNTRIES WHO HAVE MADE OUTSTANDING CONTRIBUTIONS TO ADVANCEMENTS IN BASIC SCIENCES.

Awards are given in biology, chemistry, mathematics, physics and basic medical sciences. The following individuals have been selected in 1999:

BASIC MEDICAL SCIENCES

- **Esper A. Cavalheiro**
Universidade Federal de São Paulo
Escola Paulista de Medicina
Depto. de Neurologia e Neurocirurgia
São Paulo, Brazil

For his fundamental contributions to the field of neuroscience, in particular for the development of an experimental model that has advanced our understanding of basic mechanisms of epilepsy

BIOLOGY

- **Raghavendra Gadagkar**
Centre for Ecological Sciences
Indian Institute of Science
Bangalore, India

For his work on indigenous Indian wasp species that has made fundamental contributions to our understanding of the origins of social life among insects

CHEMISTRY

- **Darshan Ranganathan**
Discovery Laboratory
Indian Institute of Chemical Technology
Hyderabad, India

For her outstanding contributions to bioorganic chemistry, particularly in supramolecular assemblies, molecular design and chemical simulations of key biological processes, as well as for designing hybrid peptides leading to a new class of cyclic receptors and membrane ion carriers

MATHEMATICS

- **Servet Martinez**
Depto. de Ingeniería Matemática
Facultad de Ciencias Físicas y Matemáticas
Universidad de Chile
Santiago, Chile

For his significant contributions in probability theory, in particular conditionally invariant distributions in Markov processes and dynamical systems, and for the study of deep connections between ultrametricity and potential theory

[CONTINUED PAGE 21]

PHYSICS

- **Nai-ben Ming**

State Key Laboratory of Solid State Microstructures
Nanjing University
Nanjing, China

For design and fabrication of periodic and quasiperiodic dielectric superlattices and realization of second harmonic generation (SHG), multiple wavelength

SHG, third harmonic generation, optical stability, polariton excitation, and ultrasonic generation with high frequency

• • •

Prize winners will be honoured at TWAS's next General Meeting, which is scheduled to be held from 23 to 25 October 2000 in Tehran, Islamic Republic of Iran. Each prize consists of a plaque commemorating the award and a cash prize of US\$10,000.

TWAS MEDAL LECTURES 2000

EACH YEAR, THE ACADEMY AWARDS TWAS MEDAL LECTURES TO THREE MEMBERS FOR THEIR OUTSTANDING CONTRIBUTIONS TO THE ADVANCEMENT OF SCIENCES. MEDAL LECTURES FOR 2000 HAVE BEEN AWARDED TO THE FOLLOWING EMINENT SCIENTISTS:

BIOLOGICAL SCIENCES

- **Frederick I.B. Kayanja**

Mbarara University
Mbarara, Uganda

ENGINEERING SCIENCES

- **Lu Yong Xiang**

Chinese Academy of Sciences
Beijing, China

PHYSICAL SCIENCES

- **Yousef Sobouti**

Institute of Advanced Studies
in Basic Sciences (IASBS)
Zanjan, Islamic Republic of Iran

Recipients of the TWAS Medal Lecture will deliver their lectures and receive a plaque commemorating the award at the Academy's next General Meeting in Tehran, Islamic Republic of Iran, 23-25 October.

Additional information about the TWAS Awards in Basic Sciences and the TWAS Medal Lectures and Awards may be found at <http://www.ictp.trieste.it/~twas/>.



PEOPLE, PLACES, EVENTS



José I. Vargas

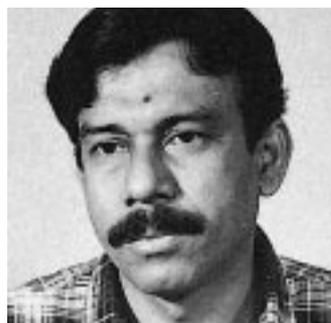
VARGAS IN PARIS

• **José I. Vargas**, President of the Third World Academy of Sciences (TWAS) and Third World Network of Scientific Organizations (TWNISO), has been appointed the Brazilian Ambassador to the United Nations Educational, Scientific and Cultural Organization (UNESCO). He is scheduled to assume the post this spring. Vargas enjoys a long-standing relationship with the UNESCO not only through his affiliation with TWAS, which is administered by UNESCO, but as a member of UNESCO's Executive Council from 1982 and 1988 (serving as the Council's vice-president in 1985-1986 and president in 1987-1988). Vargas plans to focus a good deal of his time and attention in Paris on efforts to advance co-operative science and technology initiatives among Third World countries. Specifically, he will seek to promote strategies enabling African nations to make use of Brazil's data collecting satellites for climate monitoring and lend support to the United Nations University project for the creation of automated translations of scientific texts into many languages — which advances in electronic communications will soon make possible. The latter should be welcome news for Third World scientists who will be able to present and examine the latest research

findings in their own language. As Vargas takes on these new challenges, he will be stepping down from his post as President of TWAS and TWNSO, which he has served with distinction since 1994. He will officially retire from these dual positions soon after TWAS's 12th General Meeting, scheduled to take place in Tehran, Islamic Republic of Iran, this autumn.

PAL HONOURED

• TWAS Fellow (1999) **Sankar Pal** has been given the 1999 G.D. Birla award for his outstanding contributions to the field of machine intelligence. Pal, who heads the machine intelligence unit at the Indian Statistical Institute in Calcutta, was honoured for work on pattern recognition, machine learning and image processing. At a practical level, his studies have shed light on



Sankar Pal

the development of advanced computer systems and neuro-fuzzy intelligent systems for diagnosis of skeletal and cancerous growth. The award, which carries a cash prize of 150,000 rupees (US\$3500), is funded by the K.K. Birla Foundation. Established in 1990, the foundation bestows honours and encourages activities in the fields of education, literature, culture, art, music, scientific research and sport.

EL-BAZ RESEARCH AWARD

• **Mohamed Sultan**, a geologist and environmental scientist at Argonne National Laboratory and adjunct associate professor in earth and environmental sciences at the University of Illinois, Chicago, in the United States, is the first recipient of the Farouk El-Baz Award for Desert Research. Sultan was honoured for advancing our understanding of desert rock chronology and for the instrumental role he played in establishing a Centre for Environmental Hazard Mitigation at Cairo University. The award, which was established in June 1999 to recognize and encourage excellence in arid land studies, is administered by the Quaternary Geological Division of the Geological Society of America, whose membership now totals 16,000 worldwide. It is named in honour of TWAS Fellow (1988) and Council Member, Farouk El-Baz, who has gained a worldwide reputation for his pioneering applications of space photography in increasing our understanding of arid terrain, especially in relation to efforts to locate groundwater resources.

DEVELOPMENT CONFERENCE

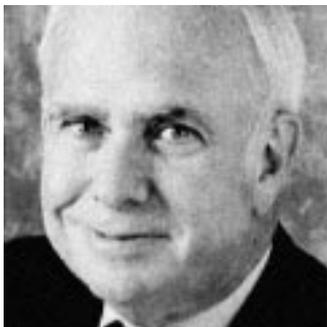
• The 16th International Training Programme on "Rural Industry Promotion In Developing Countries," will take place from 4 October to 22 November 2000 in Rajendranagar, Hyderabad, India. The meeting, sponsored by the National Institute of Rural Development (NIRD) Centre for Rural Industries and Employment, will focus on employment generation and poverty alleviation through small business growth in rural areas, institutional capacity build-



ing, entrepreneurship, and the empowerment of women. More than 350 officials from 50 nations have participated in the programme since its inception. For additional information, please contact B. Sudhakar Rao, Director, Centre for Rural Industries and Employment, National Institute of Rural Development, Rajendranagar, Hyderabad-500 030 India; phone and fax: + 91 40 4015747 (office) or + 91 40 4015261 (home); e-mail: bsr@nird.ap.nic.in.

RAVEN AAAS PRESIDENT-ELECT

- **Peter Raven** (Twas Associate Fellow 1993) has been named president-elect of the American Association for the Advancement of Science (AAAS). The announcement took place at the AAAS annual meeting held in Washington, D.C., this past February. Raven, who was born in Shanghai, China, and educated in the United States, is the director of the Missouri Botanical Garden and the Engelmann Professor of Biology at Washington University in St. Louis, Missouri. His term as AAAS president will begin next year. Established in 1848, the AAAS is a nonprofit organization dedicated to the advancement of science in all disciplines and to increasing public



Peter Raven

understanding of science and technology. Membership worldwide, which includes scientists, engineers, science educators and policy makers, currently stands at 140,000.

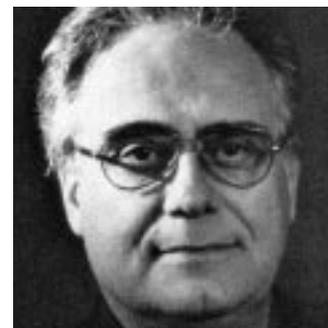
WIDE WIDE INITIATIVE

- The United Nations Development Programme (UNDP), Special Unit for Technical Cooperation Among Developing Countries SU/TCDC) has launched the "WIDE Initiative" (Web of Information for Development). The initiative includes: (1) "WIDE Online": a public access database on the internet for collecting and accessing user-maintained data on experts, institutions and innovative experiences in the South; (2) "WIDE InterLink": a strategy for assisting TCDC stakeholders to make use of the WIDE Initiative and its services to strengthen stakeholder capacity for sharing expertise and promoting technical cooperation among developing countries; (3) TCDC/WIDE Innovative Experiences: a database containing details of experiences and projects demonstrating innovative development activities carried out by institutions or groups in developing countries, including the case studies highlighted in the SU/TCDC/TWNSO/TWAS "sharing innovative experiences" project; (4) WIDE Discussion Forums: online policy forums designed to strengthen technical cooperation among developing countries organized in cooperation with Belanet; and (5) TCDC/WIDE News Service: a partnership between Comcast Inc., a Republic of Korea internet broadcasting service, and SU/TCDC for the delivery of an online state-of-the-art news service focusing on development and South-South

cooperation. All "WIDE Initiative" services can be accessed through <http://www.undp.org/tcdc/wide/>.

PANZA HONOURED

- The European Geophysical Society has awarded **Giuliano Francesco Panza** (Twas Associate



Giuliano Francesco Panza

Fellow 1996) the Beno Gutenberg Medal. Panza, professor of seismology at the University of Trieste and head of the Abdus Salam International Centre for Theoretical Physics (ICTP) Structure and Non-Linear Dynamics of the Earth (SAND) programme, is being honoured for his scholarly achievements in earthquake modelling and for advancing international cooperation in earthquake analysis and prediction. The award, established in 1996, is named in honour of the great German-born seismologist who is credited with discovering the Earth's core and helping to explain the physics of continental drift. The award ceremony is scheduled to take place in Nice, France, this spring during the opening of the XXV General Assembly of the European Geophysical Society.

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 546 members from 77 countries, 63 of which are developing countries. A Council of 14 members is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a small secretariat of 9 persons, headed by the Executive Director. The secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. UNESCO is 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 (TWNISO), a non-governmental alliance of 155 scientific organizations from Third World countries, whose goal is to assist in building political and scientific leadership for science-based economic development in the South and to promote sustainable development through broad-based partnerships in science and technology.

TWAS also played a key role in the establishment of the Third World Organization for Women in Science (TWOWS), which was officially launched in Cairo in 1993. TWOWS has a membership of more than 2000 women scientists from 87 Third World countries. Its main objectives are to promote the research efforts and training opportunities of women scientists in the Third World and to strengthen their role in the decision-making and development processes. The secretariat of TWOWS is currently hosted and assisted by TWAS.

WANT TO KNOW MORE?

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