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Water is a fundamental constituent of life and the environment. Its use and conservation affects all aspects of sustainable socio-economic development. And, as we are often reminded by the tragic effects of drought and flooding, it is a crucial natural resource.

At the dawn of the third millennium, water has also become a strategic commodity, as providing good quality freshwater to all at an acceptable cost becomes increasingly difficult. Even in regions with high precipitation rates and in major river basins, overuse and mismanagement of water resources have constrained supplies. Much of this stress is experienced in developing countries where adjustments in living conditions due to interruptions in water supplies are usually more severe.

During the past century, several severe droughts often affecting developing countries were interspersed with years marked by above normal rainfall levels. Recall, for example,

Water and Development

widespread and recurrent droughts during the past four decades in Africa, where several sub-regions, particularly in sub-Saharan Africa, experienced periodic droughts on an annual basis. Sharp drops in precipitation adversely affected freshwater resource management and contributed to enormous human suffering and economic loss due to reductions in crop yields and the generation of hydroelectric power.

Meanwhile, several Third World countries, such as Bangladesh, China, Mexico and Somalia, experienced periods of overly abundant rainfall leading to major floods and landslides with significant socio-economic impacts. Excessive rainfall not only caused major loss of human and animal life, spread of water-borne diseases, agricultural destruction, and infrastructure damage, but posed grave risks to hydrological facilities and the ability to provide clean and safe fresh water.

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The World Meteorological Organization (WMO) believes that a better understanding of the scientific, technological, economic and institutional factors shaping our hydrological systems play a vital role in devising strategies for the sustainable use and management of water resources. WMO is convinced that research initiatives should be promoted and enhanced, particularly those related to the potential impact of climate change on freshwater resources, both globally and regionally. The scientific community, moreover, must ensure that their findings are translated into action-oriented recommendations that can be used in national and international policy evaluation, formulation, and planning.

An integrated approach to freshwater management offers a means of reconciling competing demands with dwindling supplies, as well as a framework for effective regional and international co-operation. In this regard, the exchange of experiences and adoption of the best practices will be indispensable for countries to successfully manage their water resources.

That is why WMO has joined the United Nations Educational, Scientific and Cultural Organization (UNESCO) in supporting the Third World Network of Scientific Organizations (TWNSO) project, "Promoting Best Practices for Conservation, Management and Sustainable Use of Water Resources in the South." The project not only aims to identify and disseminate best practices for conserving and improving the quality and quantity of water resources in the Third World, but also to promote collaboration between centres of excellence with expertise in hydrology and water resources management.

Such an undertaking presents an opportunity for the South to embrace best practices for sustainable water development by enabling it to find indigenous solutions to problems rather than embracing applications of questionable utility from the North. Indeed we expect the TWNSO project to increase access to information on best practices for the conservation and sustainable use of water resources in the Third World as well as to encourage partnerships and co-operation among all institutions of excellence in the South devoted to water resource management issues. ■

❖❖❖ **Mohamed Tawfik**
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IAP AND THE TRIESTE SYSTEM

Since the end of World War II, the Italian government has dedicated an increasing amount of resources to the promotion of global peace and progress through support for institutions that nurture scientific and cultural exchange among nations.

No effort is more exemplary than the Italian government's sponsorship of a cluster of international centres of scientific excellence that have been built over the past 35 years in Trieste, a city

of some 250,000 residents tucked away in the northeast corner of Italy on the shores of the Adriatic Sea near the border with Slovenia. In fact, the success of our efforts have helped transform Trieste's image of a city known for ship-building and coffee processing to one known as a distinctive science centre dedicated to helping scientists and scientific institutions in the developing world.

Among the key institutions forming part of what has come to be called the Trieste System are the Abdus Salam International Center for Theoretical Physics (ICTP), founded in 1964; the Third World Academy of Sciences (TWAS), founded in 1983; the International Centre for Genetic Engineering and Biotechnology (ICGEB), founded in 1987; and the International Center for Science and High Technology (ICS), founded in 1988.

These institutions, which receive most of their funding from the Italian government, have been cre-

ated to promote international cooperation and exchange in the fields of physics, mathematics, genetic engineering and biotechnology.

A key goal of the system is to assist developing countries in strengthening their scientific and technological capabilities. Together with the University of Trieste and other scientific institutions, such as the *Elettra* synchrotron radiation light source laboratory and the Italian National Research Council (CNR), the Italian Commission for New Technologies, Energy and the Environment (ENEA), and the Italian National Institute for Nuclear Physics (INFN) (all of which have regional offices in Trieste's AREA Science Park), ICTP, TWAS, ICGEB and ICS form part of a significant group of institutions that have earned a worldwide reputation, especially for their strong and enduring partnerships with scientists and scientific institutions from developing countries.

With the end of the ideological divisions that defined the Cold War,





globalization of markets and culture has become one of the driving forces in a world that seems to be moving both closer together and farther apart at the same time. Technology, and the science that propels it, are key ingredients in the paradoxical situation in which the global community finds itself during the first years of the new millennium.

New information technologies in particular have generated a great deal of hope that the gnawing gap in material well-being between the North and South can be closed by the rapid diffusion of data and information. But that promise has been tainted by an equally compelling portrait of reality, which reveals that one-third of the world's population — some 2 billion people — are excluded not only from the benefits of distant technological innovations but also from local technologies simply because they do not have the knowledge or skills to take advantage of even relatively basic scien-

tific and technical information. For these “technologically dispossessed,” it is not a matter of languishing below a certain level of economic well-being; rather, it is a case of being left out of the economic arena all together.

Innovation, especially the high-technology-driven innovation of the new millennium, tends to favour those who are already successfully involved in the development of new technologies. Ideas foster new ideas and existing technologies push towards new technological boundaries. That's why our era is filled with such paradox. The forces that offer such hope for improvement in the developing world are the same forces accounting for increasing disparities between the rich and poor.

This is not the place to examine the factors that both describe and explain the wide-ranging gaps that currently exist between the North and South — for example, in governance, education, public health, food production and energy use.

Neither is it the place to explore the lessons from past experiences that governments and international aid agencies might apply to future development policies.

But I do think that it is worth noting with subdued pride (subdued because the task is immense and we all know that we should be doing much more than we actually do) that in Trieste hundreds of scientists are working in institutions dedicated to helping Third World countries adopt and embrace advanced technology. Their ultimate goal is to narrow the gap between slower and faster innovating regions around the globe.

New ideas are often generated by revamping existing ones. As a result, environments rich in ideas often spark a chain reaction of innovations.

The Italian government believes that the InterAcademy Panel (IAP) has a fundamental role to play in this respect: Its task is nothing less than helping to promote a more equitable world at a

time when concerned citizens throughout the globe concur that inequality in innovation and in the sharing of technology are at the core of a North-South divide made even more intractable by globalization.

It is easy to prophesize that the industrialized world's rapid scientific and technological progress during the past century will continue at an even swifter pace in the years ahead. It is also easy to prophesize that global problems affecting welfare and even the survival of humanity will increase both in number and intensity. International organizations like the United Nations, regional organizations like the European Union, and national governments, which have had to face similar problems in the past, will need the most up-to-date and unbiased scientific data and information to confront these challenges in the future.

Last year, the Italian government gave its active diplomatic

support to TWAS to serve IAP's secretariat. The Italian government now reaffirms its commitment by announcing that it will make an annual contribution of half a million Euro to help fund IAP programmatic initiatives both in 2001 and 2002.

A great Iranian poet, Omar Khayyam, wrote:

*There was a veil past which
I could not see
There was a door to which
I found no key*

Critics of science contend that science only provides temporary results that require continuous updating and, moreover, that science only offers a series of possible scenarios on the future condition of the Earth that we inhabit and whose natural bounty we depend on for well-being and survival.

The truth is, however, that science gives us a key to a door that could open a world free of want, ignorance and hostility — a world that is made better for all of us and

not just those fortunate enough to be born in the right place and at the right time.

Such are the bright expectations that the Italian government has harboured for science since World War II and such are the expectations it now extends to the IAP, which we are honoured to welcome as the newest member of the Trieste System. On behalf of my government, I wish IAP every success in meeting the challenging tasks it faces in seeking to build scientific capacity and to expand the role of science in decision-making throughout the globe, particularly in the developing world. ■

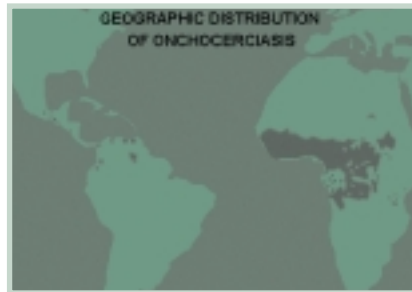
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PATHWAYS OF HOPE

PROGRAMMES TO COMBAT RIVER BLINDNESS PROVIDE BOTH A SUCCESS STORY AND CAUTIONARY TALE.



Just a decade ago, it was not unusual for one of every three villagers in parts of Burkina Faso, Ghana, Nigeria, and other nations in sub-Saharan Africa to be afflicted by river blindness each year. Today, virtually no one is. The progress that has been made in combating this disease, which has been most prevalent in Africa and Central and South America, represents one of the most triumphant public health campaigns ever waged in the developing world.

But will this success continue? Nobody's sure. The reason for concern is that the parasites causing the disease are likely to build resistance over time to the successful drug therapies that have been put into practice. For this reason, TWAS Fellow (1997) Thomas G. Egwang and his colleagues at the Medical Biotechnology Laboratories at Makerere University in Kampala, Uganda, are seeking alternative treatments based on the medical community's rapidly advancing knowledge of molecular biology and, more specifically, biochemical pathways.

Such knowledge could help researchers devise carefully targeted strategies designed to disrupt the disease-carrying parasites' basic molecular functions. That, in turn, could serve as the basis for undermining the parasites' vitality and disrupting their reproductive cycles.

To assist Egwang in his efforts, the Howard Hughes Medical Institute, the largest non-profit medical research organization in the United States, has awarded him a 5-year, US\$250,000 grant. Egwang was one of 45 scientists, all experts in infectious and parasitic diseases working outside the United States, to receive support. Neuroscientists, immunologists, cellular and structural biologists, as well as geneticists, were among the grant recipients.

It's difficult to believe that such a small, insignificant organism could cause such a large problem. But nematode parasites, or what most people call round worms, have brought about one of the developing

world's most troublesome public health problems: river blindness. Medical experts estimate that between 18 and 20 million people, most living in Africa and Central and South America, have been afflicted with the ailment and that 300,000 of the victims have suffered from its most devastating effect: onchocerciasis, an acute inflammation of the eyes, which can cause blindness.

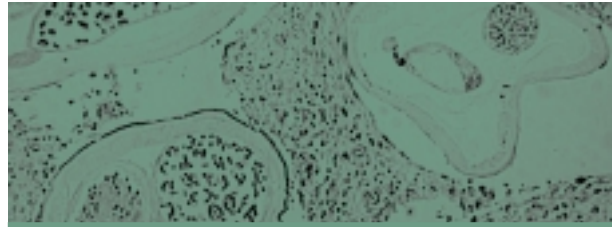
"River blindness," explains TWAS Fellow (1997) Thomas Egwang, director general of the Medical Biotechnology Laboratories in Kampala, Uganda, "is the common name given to the affliction caused by a nematode parasite or round worm (*onchocerca volvulus*).

Blindness is the most acute and debilitating effect. But other problems include skin lesions, which are associated with unbearable itching; loss of black pigment, which creates unseemly skin patches among blacks victimized by the disease; and abnormal elasticity, which causes skin to hang loosely from the arms and other extremities. "It's both a physically and psychologically devastating disease," notes Egwang, "that has ruined the lives of millions of people, many of whom are among the world's poorest and most vulnerable citizens."

Fortunately, recent breakthroughs in medical research have reduced the impact of river blindness that is transmitted by the bite of the black fly. As a result, we are now largely living with the legacy of its devastation. While Egwang applauds the progress that has been made, he is also leery about the long-term sustainability of the current drug treatments.

He explains the situation this way: "Ivermectin is the only drug currently available that successfully stymies the disease. Over the past decade, the global drug company Merck has distributed ivermectin free-of-charge to heavily infected areas in Africa and Central and South America." Wide distribution of the drug, combined with effective vector control (aerial spraying

to kill flies that transmit the parasites) account for the dramatic decline in annual rates of infection. To aid in this effort, Helen Keller International's Onchocerciasis Division, established in 1991, has worked closely with African ministries of



MULTIPLE IMPACTS. *River blindness derives its name from the fact that scientists first identified concentrations of the disease along fertile, often soggy, lands surrounding fast-flowing rivers. These lands serve as ideal environments for the breeding of black flies that transmit the disease. But the disease is also present in drier savanna environments, for example, in Yemen and other Arabian countries. Scientists don't know why, but river blindness found in humid environments can ultimately lead to blindness while afflictions of the disease in drier savanna environments do not. Under any circumstances, river blindness is a problem of enormous human consequence. Not only is it the third leading cause of blindness in Africa, but even its lesser health impacts — lesions, itching, discoloration — take an enormous toll. A recent case study in Ethiopia, for instance, concluded that workers on the nation's second largest coffee plantation infected with the disease were 15 percent less productive than uninfected workers, and that when the head of a household suffered from acute river blindness, the risk of a child leaving school became twice as high than in families where the head of household does not suffer from the disease. Simply put, the human and psychological costs of river blindness often carry untold social and economic costs as well.*

health and nongovernmental organizations to raise public awareness about the disease and to help ensure that effective community networks are created for ivermectin distribution.

"The problem," Egwang continues, "is that ivermectin only kills the parasites in their larval, not adult, stage, and adult worms can live within infected individuals for 15 to 20 years. In fact, the parasites often





lie buried within skin nodules or lumps that are symptomatic of the disease.”

Research on round worm infestation in animals indicates that parasites are building increasing resistance to existing therapies. Although such ominous trends have yet to surface among the human population, Egwang and his colleagues are convinced that it is just a matter of time. “The challenge,” he says, “is to uncover alternative therapies before drug-defying parasites become prevalent.”

The first step in dealing with this potential problem is to identify suitable biochemical drug targets within the cells of the parasite. “That’s not as easy to do as it might appear,” says Egwang. “We may know that the targets are out there but we don’t know whether they constitute an Achilles heel. There’s always the possibility that we won’t be able to identify the markers until the resistant mechanisms are genetically coded within large segments of the parasite population. As is true in all efforts of this kind, the crucial step in our drug development strategy is validation.” The problem is that, while such efforts go on, additional people will contract the disease and those that do will find it more difficult to receive effective treatment.

Once the biochemical targets are identified and validated, the second step is to develop effective

inhibitors. The key is to locate metabolic pathways so unique to the parasite that selective inhibitors have no adverse effects on human cells. Again this is eas-

ier said than done because hosts and parasites share many metabolic pathways.

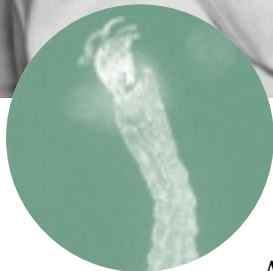
With funding from both the World Health Organization (WHO) and the International Atomic Energy Agency (IAEA), the Medical Biotechnology Laboratories in Kampala, Uganda, which Egwang has directed since 1995, has focused much of its

research on such “pathway” strategies. The laboratory’s staff, consisting of 10 scientists, also studies molecular markers of drug resistance.

“We have operated on an annual budget of US\$250,000 a year, which has come exclusively from outside sources,” says Egwang. “That’s why we were so encouraged when an e-mail message arrived in autumn 1999 asking us to submit a grant application to the Howard Hughes Medical Institute’s international research programme. It was an opportunity that we were not about to let slip by.”

Eight months later, when Egwang received notice that his grant proposal had been approved, he remembers “breaking into a grin and punching the air in delight.”

Medical experts estimate that between 18 and 20 million people, most living in Africa and in Central and South America, have been afflicted with river blindness.



The Hughes grant offers a great deal of latitude on how recipients may spend the money.

As Jill Conley, the institute's senior programme officer who is overseeing the Egwang grant, explains: "Funds can be used to cover any of a number of expenses that a researcher is likely to incur in pursuing his or her research agenda, including the purchase of laboratory equipment and supplies, travel, publications, and stipends and salaries for scientists, students and technicians."

Egwang intends to invest the grant money he receives from Hughes on local training programmes that will teach young African scientists about state-of-the-art molecular techniques. "Issues related to river blindness will be our primary focus," he notes. "But what participants will learn can also be applied to the study and treatment of other parasitic diseases, including malaria. That's what makes the learning process so valuable. Once the skills are acquired, researchers will have many opportunities to contribute to improvements in public health."

"African scientists must become more proactive in setting the agenda for studies and applications of molecular biology," Egwang adds. "We can no longer afford to remain passive recipients in efforts to advance this new promising technology because, if we remain on the sidelines, it's unlikely that the technology will be used to address medical issues of importance to the developing world." One way to increase the prospects for developing-world participation, Egwang observes, is to nurture centres of excellence in the South. And no continent is in more need of these centres than Africa.

Egwang contends that African scientists will happily stay at home to pursue their careers if they can be assured of reasonable working conditions and pay. Those prerequisites can only be fulfilled through large sustainable investments in scientific personnel and facilities.

"Unfortunately, the money that has been invested in institutes like mine, however welcome and valuable the resources have been, has come almost exclusively from external sources. In most cases, we have yet to convince our own governments about the value of our work and

the impact that our findings could have on the future social and economic well-being of our people.”

That’s why Egwang believes that scientists in Africa and elsewhere in the developing world must shoulder the additional responsibility of serving as ambassadors for science who are willing to work the political corridors of their nation’s capitals to ensure that their research efforts and those of their colleagues receive adequate financial support.

Officials at Hughes recognize the enormous obstacles faced by scientists in the South, particularly those living and working in the most impoverished regions. “Our efforts,” explains Conley, “represent a modest attempt to help scientists improve the classroom and laboratory environments in which they work. Since the institute’s international research scholars programme was launched in 1991, we have provided some US\$50 million to 177 research scientists working in 19 countries. The majority of our recipients have not only gone on to do excellent research but have also gained increasing visibility within their countries.”

“The ultimate goal,” Conley says, “is to increase the research capacities within developing countries in

ways that gain both scientists and scientific institutions the recognition that they need to wage effective campaigns for funding from their own governments.” As Thomas Egwang observes, such “recognition is likely to determine the sustainability of our efforts over the long term.”

That helps to explain why Conley is so pleased by the willingness of the Ugandan government to forego custom fees on equipment and supplies that Egwang will purchase from his grant funds. In addition, the government has agreed to support two graduate students who will work in his laboratory.

“These actions,” says Conley, “are welcomed indications that the Uganda government wants to invigorate scientific research and is serious about solidifying the nation’s infrastructure in science” — all encouraging signs that the Hughes grant funds may not only help advance the research agenda of individual scientists but help boost governmental commitments to science as well. ■

Egwang believes that scientists in Africa and elsewhere in the developing world must serve as ambassadors for science.

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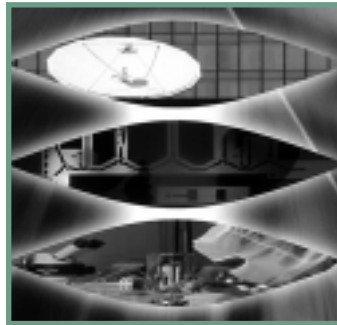
ENTREPRENEURIAL SCIENCE

THREE TRIESTE-BASED INSTITUTIONS — ICTP, TWAS AND ICS — RECENTLY CO-SPONSORED A WORKSHOP TO PROMOTE ENTREPRENEURIAL ACTIVITIES IN THE MEDITERRANEAN REGION, PARTICULARLY AMONG DEVELOPING COUNTRIES.

As recent international tests assessing student achievement show, over the past few decades many nations in the developing world have made noteworthy strides in the promotion of science and mathematics education. In fact, students in such developing countries as China, Iran and Korea now routinely outscore students in such developed countries as Australia, Italy and the United States in international mathematics and science tests that are designed to measure and compare the knowledge and skills of students worldwide.

Where developing nations have fallen short is in their efforts to devise strategies for applying the skills and talents of their home-grown scientists and technologists to real-world issues in ways that would have concrete economic payoffs in our increasingly global society.

That's the gap that participants in the "Workshop on New Economy and Entrepreneurial Business Creation



in Mediterranean Countries" sought to address during discussions that took place from 2-4 December, on the campus of the Abdus Salam International Centre for Theoretical Physics (ICTP). Some 30 individuals from 14

nations, including Cyprus, Egypt, Jordan, Lebanon, Morocco, and Tunisia, took part in the event.

The gathering was significant not only because it closely examined an issue of critical importance to the future of the developing world but also because it marked the first time in the history of the international scientific community in Trieste that the ICTP, the Third World Academy of Sciences (TWAS) and the International Centre for Science and High Technology (ICS) joined forces to co-sponsor an activity.

As Gallieno Denardo, former head of ICTP's Office of External Activities who spearheaded the effort to organize the workshop, notes: "The three Trieste-based scientific institutions have common roots, are

located near to one another, and pursue complimentary areas of expertise that should make them natural partners in cooperative ventures like this.”

All three institutions, for example, are administered by United Nations organizations: ICTP by the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the International Atomic Energy Agency (IAEA); TWAS by UNESCO; and ICS by the United Nations Industrial Development Organization (UNIDO). And all three institutions receive the majority of their funding from the Italian government.

ICTP’s admirable track record in the organization of training and research activities in the basic sciences for researchers from the developing world, TWAS’s access to a worldwide network of eminent scientists from the developing world who have been elected members of the Academy, and ICS’s focus on the promotion of sustainable development in the South through effective strategies for technology transfer collectively provide a wide range of capacities that could be put to good use in workshops, seminars and schools which scientists and administrators throughout the South would find extremely valuable. That’s why Denardo hopes the December workshop on entrepreneurial business creation will mark the first of many joint ventures in the future.

As Rustom Lalkaka, who was given the task of organizing the workshop, observes: “A primary goal of developing countries should be to encourage their scientists to become entrepreneurs who are more directly involved in real-world change.” A native of India and for many years a high-level official with UNIDO and UNDP, Lalkaka now heads his own global technology consulting firm headquartered in New York City.

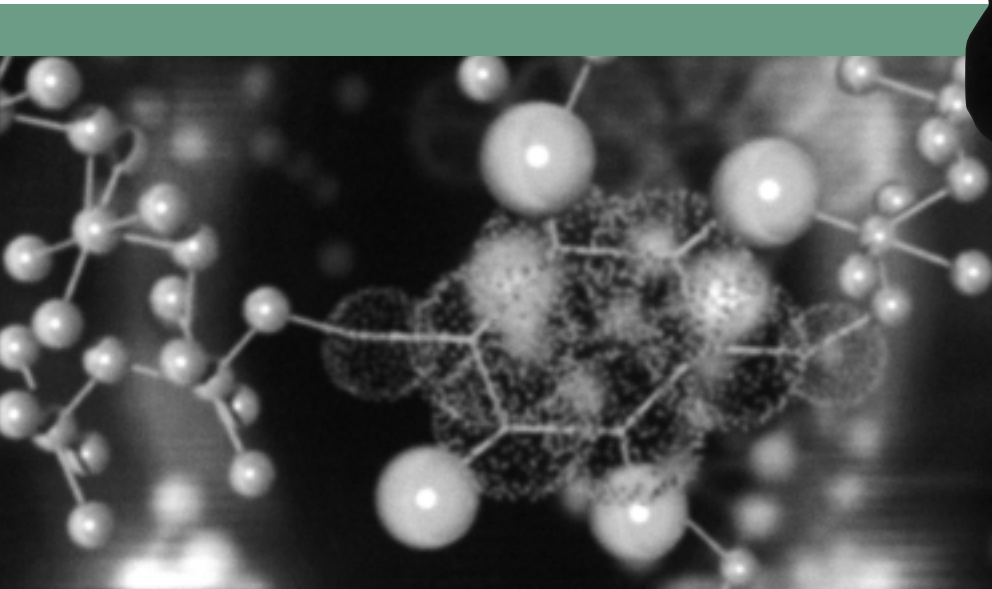
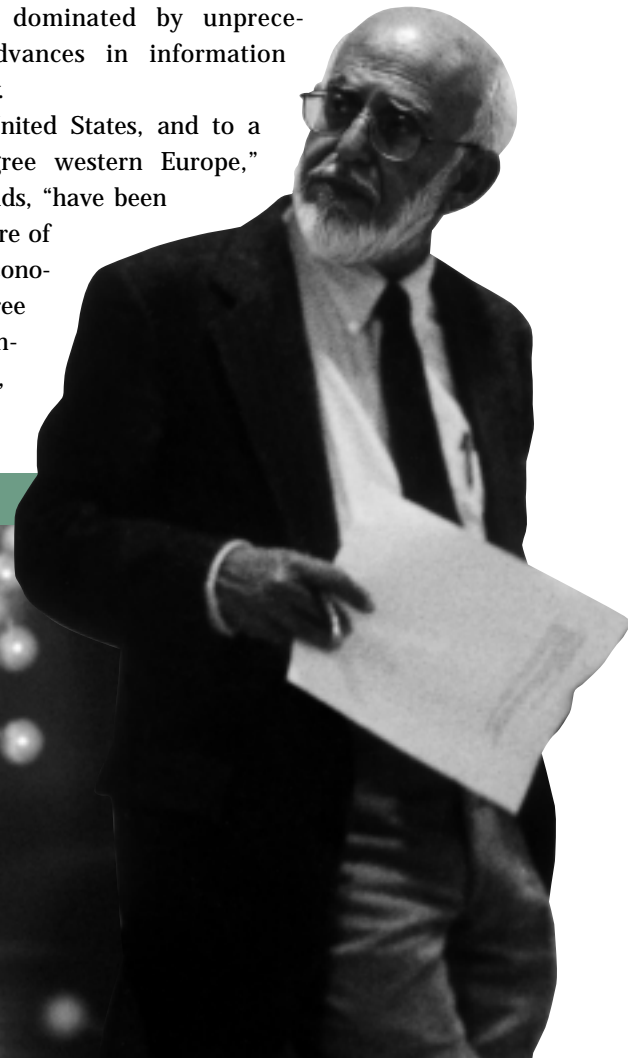
“Science and technology,” he notes, “have been important drivers of economic development since the industrial revolution. During the past decade, however, technological innovation and

entrepreneurship have become two of the most indispensable agents of the new economy, which has been dominated by unprecedented advances in information technology.

“The United States, and to a lesser degree western Europe,” Lalkaka adds, “have been at the centre of the new economy. The free flow of information, an uncom-

Developing countries must solve the problems of the old economy while concurrently hitching up to the new economy.

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promising emphasis on competition, and the careful nurturing of an economic environment that encourages and then rewards risk all have helped fuel the unprecedented science-based economic growth that has taken place in these two regions during the past decade.”

Lalkaka acknowledges that the developing world has been saddled with problems that have made it difficult for countries in the South to keep pace with the dramatic end-of-the-millennium advances in science and technology that have benefited countries in the North.

“Developing countries,” he states, “are in the unenviable position of having to solve the problems of the old economy (for example, political instability, insufficient capital, chronic poverty, inadequate and antiquated communication systems, and legal and regulatory uncertainties) while concurrently hitching up to the new economy.” Yet for Lalkaka and many observers

of current global technology and economic trends, the one undeniable fact is that if developing countries fail to address the challenges of both the old and new economy at the same time, the low living standards

found in many countries of the South are likely to sink even lower than those in the North in the years ahead.

While the challenges facing developing countries are largely rooted in economic and political problems, Lalkaka maintains that they are also bound to the way in which people in the South view the world. Whereas information

is exchanged freely in the North, it often moves “from the top down” in the South; whereas competition is the hallmark of economic activity in the North, many economies in the South (despite recent reforms) remain constrained by government bureaucracies or long-standing patterns of ownership that place economic power in the hands of a few elite families or

If developing countries fail to address the challenges of both the old and the new economy at the same time, their low living standards are likely to sink even lower.

institutions; and while risk-taking is accepted as a way of life in the North, security and tradition are more highly valued in the majority of countries in the developing world.

When it comes to the new economy, however, the news is not all bad for developing countries. In fact, Lalkaka believes that “the centre of gravity of the new economy could well shift to the developing world in the years ahead, especially in regions like the Mediterranean.”

“Not only do developing nations have a growing number of well-trained scientists who (under the right circumstances) could be put to good use in efforts to promote science-based economic development, but they also are home to the world’s most rapidly growing populations,” which present the potential for tremendous market growth in the future. At the same time, the economies in many developing countries, particularly in Asia and South America, have displayed encouraging, if not always steady, annual rates of economic growth (often ranging from 5 to 10 percent) that have lured increasing amounts of capital from investors.

Recent surveys indicate that some 375 million people worldwide are on-line and that more than one-third of all internet users live and work in the United States. By 2005 conservative estimates envisage that more than 1 billion people will be on-line and that much of the increase will take place in the developing world. For example, China, with a population of 1.3 billion, currently has 10 million internet users; within 5 years that number will likely soar to 80 million; meanwhile, the Arab world, with an estimated population of 280 million people, now has 2 million internet users, a number that is expected to surge to 40 million by 2005.



NETAKEOFF

Creating Startups @ Internet Speed

GET STARTED, KEEP GOING

As Wissam El Solh readily admits, “friends, fools and family” have been the primary source of capital for his start-up company “Netakeoff.com,” which he and three associates hope to build into the Arab world’s leading innovation centre for the development of communications-based technologies.

El Solh, who founded the centre about a year ago and now serves as its chief executive officer, has devised a business plan that calls on the centre to support some 36 projects over the next 5 years. To fully realize these goals, he anticipates that his company will need to attract between US\$1.5 million and US\$2.5 million in capital investment. His primary task over the next 18 months is to convince potential financiers that his company is worth investing in.

“Our revenues will be derived from three major sources of income: the return on the investment in the start-up companies that we assist; tenant fees from firms that rent space in our innovation centre; and consultant fees for the services and advice that we render.”

El Solh, who holds a master in business of administration from George Washington University in the United States and a doctorate in economics from the Institut d’Etudes Politiques de Paris (Sciencepo) in France, spoke about his experience as a young entrepreneur in the Arab world at the joint ICTP/TWAS/ICS workshop on business creation held in Trieste in December.

He acknowledges that he faces a host of obstacles in getting his “start-up, start-up company” off the ground. Political instability and a lack of government support for such initiatives present serious problems — as do weak laws protecting intellectual property rights and equity-starved stock markets that are too small and too

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[CONTINUED PAGE 16]

cautious to provide capital to promising but risky enterprises. Firms in the Arab world, El Solh adds, often behave in ways that are not fully transparent (and therefore not fully accountable), and entrepreneurs working in the region are often skeptical of the value of incubators, fearing that these innovation centres “will steal their ideas.”

Nevertheless, El Solh is optimistic that firms like *Netakeoff.com* represent the wave of the future in both the North and South. “I would not have quit my steady well-paying job with an international oil field supplies company if I didn’t believe this could work.”

El Solh’s faith in his future is based in part on promising demographic and economic trends within the Arab world. “The annual growth rate in the number of internet users in the Arab,” he notes, “is expected to rise at least 80 percent a year for the next 3 years and reach some 40 million by 2005. That represents tremendous growth but with a population that will near 300 million, the market should continue to grow rapidly throughout the remainder of the decade and beyond.”

At the same time, El Solh notes that young Western-trained university graduates are filtering back home eager to contribute to the economic future of their countries. He cites his educational background as well as those of his associates who received advanced degrees at the University of Pennsylvania’s Wharton School and the University of Michigan’s Business School in the United States and Insead in France.

Finally, El Solh points to the emergence of investment houses in the Arab world that have shown an increasing willingness to invest capital in start-up firms like his. Indeed *The Investment House*, headquartered in Beirut, Lebanon, has begun to assess *Netakeoff.com*’s long-term prospects for profitability with an eye towards supplying the company with a welcome infusion of capital. Maher Cheaito, a representative from *The Investment House*, attended the Trieste workshop to speak about his firm’s growing interest in providing the “financial fuel” that will be necessary to ignite entrepreneurialism in the Arab world. As he noted, the region is not without potential sources of capital. “Arab nationals,” he notes, “have overseas investment portfolios that collectively exceed US\$1 trillion. The challenge is to bring that money

Similar 10- and 20-fold increases are expected to take place in countries throughout the South.

Yet, increased participation of developing countries in the internet — and, more generally, in the new economy — is by no means guaranteed. Encouraging trends in education, innovation and investment will not translate into success, Lalkaka asserts, unless measures are also taken to instill and reward “a spirit of entrepreneurship” among the people. That’s where the role of “incubators” or “innovation centres” come into play.

“Innovation and incubation centres,” Lalkaka notes, “are not new.” In fact, the concept dates back to the 1970s. Over the past few decades, however, the centres have evolved from places providing “affordable space and shared facilities into full-service incubation firms designed to provide fledgling entrepreneurs with the tools that they need to succeed in the global economy.”



As Lalkaka also notes, innovation centres are no longer the sole domain of entrepreneurs in the United States but have emerged as more prominent aspects of the business environment in developing countries as well. In the mid 1990s, Egypt had just two innovation centres; today there are more than 15. Over the past decade, China has invested more than US\$1 billion in such centres and now has more than 125 in operation, including 85 technology incubators. In 2000, Indian exports in computer software products and services exceeded US\$6 billion, transforming the nation into a major “software” player in the global economy. Many of those involved in India’s burgeoning software industry gained valuable information and experience from India’s innovation centres. Even small nations with weak unsteady economies have turned to innovation centres as prime sources of reform. Thanks to a US\$500,000 UNDP-funded programme, the former Soviet republic Uzbekistan, which launched three pilot projects in 1994, has 25 incubators today.

“Innovation centres,” Lalkaka observes, “don’t create entrepreneurs; they nurture them. These centres,” he adds, “are just one piece of the policy puzzle needed to create a healthy business climate in which entrepreneurs can flourish.”

Nevertheless the bottom line is this: The training and support that these centres offer could help entrepreneurs in the developing world meet many of the difficult challenges they face in trying to build innovative science and technology firms desperately needed to compete successfully in the new economy of the 21st century. ■

For additional information about the Workshop on New Economy and Entrepreneurial Business Creation in Mediterranean Countries and, more general, the development of innovation centres in the developing world, please contact

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home by providing attractive investment opportunities within the Arab region.”

That’s what El Solh hopes to accomplish through the growth of Netakeoff.com:

Nurture the development of high-tech start-up companies built by regional entrepreneurs and nourished by regional financiers.

To date, Netakeoff.com has identified three nascent companies from the 125 business plans that have been submitted as part of a larger competitive process for funds. The companies receiving assistance from Netakeoff.com include an “amazon.com”-like company seeking to sell Arabian language books through the internet; a business-to-business auction internet site for the trading of surplus Middle East stock; and an internet portal that will focus on information concerning e-commerce business strategies.

El Solh admits “Netakeoff.com is pursuing modest steps to address a deep and complex issue that entails fundamental changes in a nation’s and region’s institutions and mindset. Yet what the global economy has shown during the past decade is that it is virtually impossible to overestimate the amount of change that can now take place in the short term. To paraphrase an often expressed opinion, the only true constant is the ever-more accelerating pace of change. That presents both challenges and opportunities not only for entrepreneurs in the developing countries but the entire population. There is no doubt in my mind that how we meet these challenges and opportunities will play a major role in our future economic and social well-being.” ■



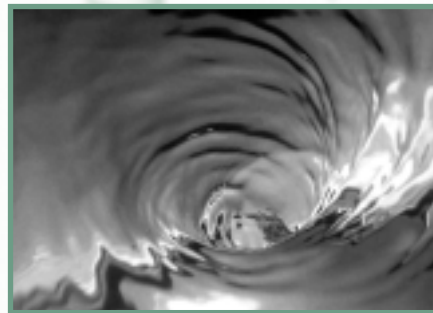
TWAS Newsletter, Vol. 13 No. 1, Jan-Mar 2001

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TO THE LAST DROP

WATER EXPERTS ARGUE WATER IS NOT JUST ESSENTIAL FOR SURVIVAL BUT IT'S A PRIME FACTOR BEHIND ECONOMIC WELL-BEING AS WELL.

Last November, a dozen experts in water management, including leading spokespersons on the issue from the World Meteorological Organization (WMO) and the United Nations Educational, Scientific and Cultural Organization (UNESCO), met in Trieste to discuss major concerns surrounding one of the world's most precious natural resources: water. The workshop, "Promoting Best Practices for the Conservation, Management and Sustainable Use of Water Resources in the South," was supported by a grant from WMO. Experts from Bangladesh, Egypt, Kenya, Kuwait, Mexico, Nepal, Pakistan, and Tunisia participated in the two-day event on 27-28 November.



indigenous plants and the development of strategies for the creation of high-technology innovation centres in the South.

"There is no more important resource than water," says

Mohammed Tawfik, WMO's Scientific Officer, Water Resources Division, Hydrology and Water Resources. "That's by no means surprising news. But the complexity of the issue is often overlooked in discussions about the future quantity and quality of the world's freshwater."

"This is not just an issue for people living on arid lands that receive insufficient rainfall; nor is it simply a natural resource issue largely confined to those who are concerned with the environment. Growing populations and rising demand for water, combined with the increased risks posed by pollution, make water management an issue that reaches into each and every locality and across all national borders."

For WMO, which is mandated to examine global trends in the world's weather and climate, water research and management have emerged as a prima-

This "water gathering" is part of a larger effort spearheaded by the Third World Network of Scientific Organization (TWNSO) to create a series of institutional networks devoted to science-based development issues of particular concern to the developing world. Other TWNSO networks have been established for the exchange of information on the sustainable use of



ry focus of its activities. “Global and regional climate,” notes Tawfik, “clearly have an impact on the world’s water resources. What the public often overlooks, however, is that water resources — our streams, rivers, lakes and oceans — directly affect both climate and weather on local, regional and global scales. Atmospheric and terrestrial ecological systems, in fact, are intricately connected in ways we are only beginning to understand.”

“Effective water management,” adds A. Salih, UNESCO’s Deputy Secretary, International Hydrological Programme Division of Water Sciences, “is a key factor behind economic development. Inadequate or polluted water supplies often limit growth in many regions of the world, particularly in the South.”

UNESCO’s focus on this vital issue dates back to 1965 with the inauguration of the International Hydrological Decade. That was followed by the cre-

ation of International Hydrological Programme in 1975. However, recent water-management trends, including the increased competition for water resources, the growing importance of regional and multidisciplinary issues, the presence of new players (including multinational corporations), and the rising voice of grassroots organizations have prompted UNESCO to re-evaluate its long-standing efforts. “The result,” explains Salih, “is a renewed dedication to the creation of networks where the exchange of information is possible. This strategy has proven one of the most effective ways for institutions in the South to learn from one another’s experiences.”

“This workshop and the subsequent activities that we hope to launch through the network,” explains Mohamed H.A. Hassan, Secretary General of TWNSO, “form part of a larger effort by TWNSO to mobilize the best of science in the developing world to address

Effective water management is a key factor behind economic development.

TWAS Newsletter, Vol. 13 No. 1, Jan-Mar 2001

practical problems. Specifically, we hope networks like this will help promote the sharing of experiences, encourage future research collaboration and strengthen efforts for the training of young scientists eager to address real-world issues.”

The November workshop concluded with a declaration calling on the 12 founding institutional members of the TWNSO/WMO/UNESCO network to establish criteria for additional membership and to devise a broad-ranging strategy to promote the sharing of information on successful experiences in the management of water resources. The network’s initial activities will include the publication of a monograph based on the case stud-

ies presented at the workshop and the launching of a website that will serve as the electronic hub for communications among all network members. ■

For additional information on the TWNSO/WMO/UNESCO network on “Promoting Best Practices for the Conservation, Management and Sustainable Use of Water Resources in the South,” please contact
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HIGH AND DRY

When people think of the majestic Himalayan Mountains blanketed by thick layers of snow for months on end, a parched environment is the last image that comes to mind. But a parched environment is exactly what many people throughout the remote Hindu Kush-Himalayan region face as they go about their daily lives in what Suresh R. Chalise describes as a “cold desert environment.”

Chalise is a water resource specialist associated with the International Centre for Integrated Mountain Development (ICIMOD), which is headquartered in Kathmandu,

Nepal. He was one of a dozen experts from the developing world participating in the TWNSO/WMO/UNESCO workshop on “Promoting Best Practices for the Conservation, Management and Sustainable Use of Water Resources in the South,” held in Trieste in late November 2000.

The 3,500 kilometer long Hindu Kush-Himalayan mountains, stretching from Afghanistan in the west to Myanmar in the east, is home to some 140 million people. For outside observers, the breathtaking natural beauty of the environment, which includes the world’s highest mountains, often masks the difficult lives experienced by many of the people

who live there. These rugged-mountain people usually depend on the region’s fragile resources and inhospitable, sometimes brutal, environment for their well-being and livelihood.

“When it comes to water,” says Chalise, “inhabitants often have too much or too little.” In fact, this is an oasis-type environment where water may be plentiful nearby rivers or lakes or by the edge of retreating glaciers during late summer. But the resource is often in scarce supply in ‘river-less’ or ‘lake-less’ parts of the region or, in winter, when the frozen tundra makes fresh water hard to come by. “Indeed water created by



glacial retreats,” he notes, “is often ‘powerful’ water that is difficult to collect and store.”

Chalise, based on research conducted with his colleague Umesh Parajuli, also points out that historically the region’s community structures developed effective systems of “water governance” that minimized potential conflicts by assuring residents an equitable share of available freshwater supplies. He cites the experience of those living in the Ghyakhar Khola micro-watershed as an example of how the system has worked.

This 16-square mile region, located in the upper reaches of Mustang District of Nepal near the border with Tibet, is home to some 200 people who not only work the land by growing cereal crops, tending fruit trees and raising livestock (including dzopas, a cross between a yak and a cow), but who also earn off-farm income through the trading of wool and medicinal plants and the transporting of goods from one place to another in this difficult-to-navigate environment.

The watershed, in fact, lies in the “rain shadow” of the Himalayas as part of undulating highland terrain ranging between 3000 and 6000 metres above sea level. Unpredictable,

highly concentrated water supplies make the systematic collection, transport and storage of this vital resource essential.

“For centuries,” Chalise says, “each inhabitant has been issued ‘water shares or chyure that have provided access to a certain amount of water.’ The system, which has been administered by the community leaders, works like this: Water is directed via earthen feeder canals from the region’s prime source, the Ghyakhar River, to a large reservoir where it is stored overnight and released the following morning. From there, the water is channeled closer to the villagers through earthen distribution canals from which each resident receives his or her prescribed daily allocation.

While demand for domestic and livestock use has never exceeded supply, the same cannot be said for water requirements for irrigation. The system has literally put a lid on the amount of water that residents can use for irrigation in a way that all residents have found reasonable. “Each week,” Chalise notes, “farming residents receive a fair share of the available water for irrigation on a ‘turn-by-turn’ basis.”

This traditional method of water allocation and use, Chalise observes,



has experienced increasing stress as greater demands have been placed on the water supply and as the population has become older making it more difficult for residents to pursue longstanding methods of water harvesting and transport that often require physical strength and stamina. Residents, after all, must carry the water from the distribution points.



To address these concerns, the government of Nepal with CARE-Nepal launched a project in 1994 (with funds from Danida, the Danish development aid organization) that was designed to improve the efficiency of the water allocation system within the fabric of existing social and economic institutions.

Part of the project focused on the rehabilitation of the porous earthen canals to reduce water loss and to increase the force of the water flow. And part of the project — indeed the major focus of the effort — concentrated on working with community organizations to achieve the reforms that were needed.

“The involvement of community organizations,” says Chalise, “meant that the reforms enjoyed a high level of credibility. That, in turn, encouraged residents to actively participate in the process.”



“The reform strategy,” explains Chalise, “involved moving beyond improvements in the infrastructure to a series of locally based initiatives that would promote self-reliance among the residents and eventually give them the confidence that they needed to address their water management problems on their own.”

That meant, for example, offering demonstration programmes on water-saving farm practices. It also meant giving residents better information on health and sanitation, which are intimately connected to the availability and wise use of water.

“Project organizers were particularly interested,” Chalise notes, “in providing women with the knowledge and skills they need to become involved in the local development process. That was essential because women usually shoulder primary responsibility for the collection and use of water in both households and farms.”

Most importantly, Chalise maintains that project organizers helped launch community development committees in each of the two major villages within the micro-watershed — Ghyakhar and Chaile. Each of the committees, with members elected by local residents, was responsible for establishing and implementing broad-based policies related to water management and develop-

ment. “With such strong community roots,” explains Chalise, “the committees quickly gained the confidence of the people they were intended to serve.”

Without exception, the work approved by the committees involved low-tech, low-cost rehabilitation projects: for example, the reconstruction of weirs and intakes along the Ghyakhar River to improve water flow to the feeder canals, and the replacement of existing earthen canals with polythene pipes.

“Some observers,” Chalise acknowledges, “contend that the project should have encouraged the planting of more tree farms to reduce water use and provide an additional source of income; or that it should have introduced more efficient drip-irrigation systems to curb the use of water for agriculture. However, such initiatives would have required extensive re-engineering of existing water delivery networks and therefore would have jeopardized traditional, community-based, procedures for water collection and control.”

“More advanced technologies may well offer more efficient methods of water management,” Chalise adds. “But ICIMOD is firmly convinced — both as a matter of principle and experience — that sustainable water management initiatives cannot be achieved without the full and active participation of the local community.”

As history shows and the experience of ICIMOD confirms, indigenous water systems are an integral part of the societies in which they exist. The challenge for water experts working in the developing world is not simply a technical challenge but involves a deep understanding of the cultures and communities that they are seeking to aid.

As Chalise cautions: “Attention to issues related to gender inequities, resource management, biodiversity and information exchange count as much, if not more so, than our knowledge of water flows, earth gradients, surface evaporation and root absorption. The truth is we all have a lot to learn and much of what we need to know lies outside of our knowledge of hydrological systems.” ■

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TWAS LOSES TWO LATIN AMERICAN MEMBERS

TWAS FOUNDING MEMBER JOHANNA DÖBEREINER AND TWAS FELLOW (1999) RENÉ FAVALORO RECENTLY DIED. THEIR COLLEAGUES SPEAK OF THEIR CONSIDERABLE CONTRIBUTIONS TO SCIENCE AND SOCIETY.

Johanna Döbereiner was born in 1924 in Czechoslovakia, studied agronomy just after World War II at the University of Munich, West Germany, and emigrated in 1951 to Brazil, where she conducted research on soil microbiology at a small laboratory of the Brazilian Ministry of Agriculture, in Seropédica, near Rio de Janeiro. She became a Brazilian citizen in 1956 and completed her masters of science at the University of Wisconsin, USA, in 1963.

From 1963 to 1969, when few scientists believed that biological nitrogen fixation (BNF) would ever be competitive with chemical fertilisers, Döbereiner led a group of students in investigating factors that were limiting BNF in tropical legumes. Since then, much of the research in this area in tropical regions has been influenced or stimulated to some degree by Döbereiner's observations and discoveries.

The Brazilian soybean breeding programme, launched in 1964, has also been influenced by Döbereiner's work. It evolved into a successful programme based on the belief that all necessary plant nitrogen could be derived from biological nitrogen fixation. Today Brazil's reliance on BNF is estimated to save the nation's farmers more than US\$ 1 billion per year in input costs.

The energy crisis of the 1970s renewed interest in BNF research and, by extension, in associations between

grasses/cereals/root crops and nitrogen-fixing bacteria. Döbereiner was at the centre of such studies from the start (with her discovery of the association of *Azotobacter paspali* with the roots of *Paspalum notatum*), and she remained a key player in this field until late in her career (with her research on the "endophytic" associations of nitrogen-fixing bacteria within the plant tissues of grasses, cereals and root crops). Her studies led to the discovery of nine species of previously unknown nitrogen-fixing bacteria.

The most spectacular results related to her research took place when some varieties of sugar cane produced 160 tons per hectare as a result of being treated with 200 kilograms of nitrogen

derived from nitrogen-fixing bacteria.

Largely due to her leadership, the small laboratory where Döbereiner worked eventually became the National Centre for Research on Agrobiolgy (Embrapa Agrobiolgy Centre), part of the Brazilian Agricultural Research Organization (Embrapa), Ministry of Agriculture. Over a career that spanned nearly half a century, Döbereiner published more than 300 papers and helped train hundreds of soil microbiologists, many of them working directly under her supervision.

Although her scientific contributions have been immense, these may not be the most distinguishing



Johanna Döbereiner

aspects of her career. Her enthusiasm was even more important, not only for the staff at the Embrapa Agrobiology Centre but for the many young scientists who were trained and inspired by her, many of whom now hold leading positions in the scientific community of Brazil and throughout Latin America.

Döbereiner's work has been recognized worldwide as evidenced by her long list of prizes, honours and distinctions, both national and international: doctor *Honoris Causa*, the University of Florida, USA, and the Universidade Federal Rural do Rio de Janeiro, Brazil; member of the Brazilian Academy of Sciences, the Pontifical Academy of Sciences and the Third World Academy of Sciences; Embrapa's Federico de Menezes Veiga prize; the Organization of American States' (OAS) Bernard Houssay Prize; the UNESCO Science Prize; the Prize for Science and Technology of Mexico;

Grand Official of the Order of Rio Branco; and the Order of Merit of the Federal Republic of Germany.

Above all, those who appreciated her strong personality (especially young women scientists for whom she served as an important role model) also prized her friendship and her capacity to come to work as happy and as enthusiastic as a person going on holiday.

Johanna was more than a leader; she was a mother to many of her students, a great friend and a symbol of pride for the Brazilian agriculture research community. ■

Maria Cristina Prata Neves, a student of Johanna Döbereiner, is a former director of the National Centre for Research on Agrobiology. She may be contacted at
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René Favaloro was born in 1925 in La Plata, the capital of the province of Buenos Aires, Argentina. He graduated in 1949 from the Faculty of Medicine at the University of La Plata in his hometown and left the following year to become a rural doctor in Jacinto Aráuz, La Pampa province, where he remained for the next dozen years.

His life took a different turn in January 1962 when he travelled to the United States for specialized training in thoracic surgery at Cleveland Clinic in Ohio. In May 1967 he performed the world's first cardiac bypass operation using a vein from the leg of a 51-year-old patient. The procedure circumvented the vascular obstruction in the heart vessel by detouring blood around the affected area. A few days later an angiogram revealed the reconstruction of the right coronary artery — testimony of a breakthrough in coronary surgery. Favaloro, simply put, deserves credit


for making the coronary bypass part of a cardiovascular surgeon's tool kit.

In a 1998 article in the *Journal American College of Cardiology*, "Critical Analysis of Coronary Artery Bypass Graft Surgery: A 30-year Journey," Favaloro tells how he realized the therapeutic implications of distinguishing between two types of heart lesions: diffuse and localized. By successfully applying the surgical bypass initially to those clinical cases marked by a single-vessel, localized disease, he proved that a simple operation could ameliorate myocardial deficiency. This insight changed the history of medicine: Before the 1960s, coronary heart disease had been treated exclusively with medication.

In 1971 Favaloro returned to Argentina, where he became the first surgeon to perform successful routine



René Favaloro



bypass operations and heart transplants. Having a profound desire to improve the training of cardiac surgeons in Argentina, he initially worked towards this goal at the Guemes Foundation in Buenos Aires. Drawing on the experience at the Cleveland Clinic, one of his priorities was to develop an institution dedicated to medical research and teaching in his home country.

Favaloro began to realize his dream in 1975 with the establishment of the Favaloro Foundation. Since its inception, the foundation has been instrumental in the education and training of generation-after-generation of cardiovascular surgeons both in Argentina and throughout Latin America. The foundation has sponsored more than 400 residents in the last 8 years alone. Moreover, more than 20,000 operations and 6000 catheterisms have been performed at the Institute of Cardiology and Cardiovascular Surgery, a landmark medical facility in Latin America founded by Favaloro in 1992.

In 1998 the Favaloro Foundation grew to unexpected dimensions, leading to the creation of the Favaloro University, a private university. A faculty of medicine was its first unit; engineering and basic and natural science units have followed.

Favaloro wrote more than 300 scientific papers, received many academic honours at home and abroad, and was an honorary professor of the University of Buenos Aires. He belonged to more than 60 scientific and academic societies and was awarded many distinctions, including the John Scott award from the city of Philadelphia (1979), the Gairdner Foundation Award (1987), the Master of Medicine Prize of Argentina (1986), the Gifted Teacher Award from the American College of Cardiology (1992), and the Prince Mahidol Prize (1999), which he received from the king of Thailand. A chair bears his name in Tel Aviv University. The American College of Cardiology recently selected an article he wrote in 1971 on the surgical treatment of acute myocardial infarction as a seminal medical publication of the 20th century.

In his last years Favaloro became highly critical of medical training in Argentina, and strongly voiced these criticisms publicly, suggesting that his country produced large numbers of medical doctors but that Argentinian doctors often received insufficient training.

Apart from being a pioneering doctor, Favaloro was consulted on a wide range of topics at home and abroad. He displayed a keen interest in history and education, and as part of his legacy leaves a conviction that education is the key to reducing inequalities and enabling the underprivileged to participate fully in society.

Favaloro's life represents a portrait of a humanitarian who found his most profound triumphs through his skills as a medical practitioner. Yet, beyond his professional and scientific achievements, Favaloro championed the cause of economic and social equality. He was profoundly concerned with the anguish of ordinary people and critically discussed pressing issues related to the free-market economy and globalization, maintaining that these phenomena were responsible for many of the distresses of the world's poor, particularly those in Third World countries. His death represents a profound loss to the medical community and to caring people everywhere. ■

Francisco J. Barrantes, TWAS fellow (1991), is a member of the Latin American Academy of Sciences, a corresponding member of the Brazilian Academy of Sciences, and a corresponding member of the National Academy of Medicine in Argentina. He may be contacted at ✉ rtfjb1@criba.edu.ar

PEOPLE, PLACES, EVENTS

ZAKRI ASSUMES DIRECTORSHIP

• **Abdul Hamid Zakri** (TWAS Fellow 1996) has been named Director of the United Nations University (UNU) Institute for Advanced Studies (IAS) in Tokyo. His tenure began 1 January 2001. Launched in 1996, the UNU/IAS conducts research and post-graduate training, focusing on natural and societal systems, both in-house and through a global network of academic institutions and international organizations. Zakri, who



Abdul Hamid Zakri

hails from Malaysia, had served as Deputy Vice Chancellor at the University Kebangsaan Malaysia (National University of Malaysia) for nearly a decade prior to his UNU/IAP appointment. From 1997 to 1999, he chaired the subsidiary body on Science, Technology and Technological Advice of the United Nations Convention on Biological Diversity. And, for the past year, he has been the co-chair of the Millennium Ecosystem Assessment, a major undertaking to assess the world's ecosystems. Zakri earned a diploma from the College of Agriculture in Malaysia, a bachelor's degree in crop science from Louisiana State University, USA, and master's and doctorate degrees in genetics and plant breeding from Michigan State University,

USA. He is a founding fellow of the Malaysian Academy of Sciences and a recipient of a Fulbright-Hayes Malaysian Lecturer Award. The Sultan of Pahang granted him the title of Darjah Indera Mahktoa Pahang in 1991 and the King of Malaysia the title of Kesastria Mangku Negara in 1993. Zakri's research has focused on genetics and plant breeding, especially rice genetics and the genetic variation of indigenous Malaysian timber species.

TWAS AND ACAL

• TWAS has signed a **memorandum of understanding** with the Latin American Academy of Sciences (ACAL). The official signing ceremony took place on 10 August 2000 at the TWAS secretariat in Trieste. Hugo Aréchiga, President of ACAL, was visiting the Academy's headquarters to explore potential areas of cooperation between the two organizations. The memorandum calls for TWAS and ACAL to work together to "foster and promote scientific research by individual scientists in Latin America" and to pursue activities to "facilitate contacts" among Latin American scientists "with the world's scientific community, especially in the Third World." Specifically, the agreement will seek to advance the exchange of scientific information, including books, journals, proceedings and databases; disseminate information on each other's programmes and activities; enable TWAS to support a joint TWAS/ACAL Prize for Young Scientists in Latin America; and encourage joint regional workshops, symposia and studies on scientific

issues of regional and global concern. Founded in 1982, ACAL currently consists of 154 distinguished scientists from 12 Latin American countries. Aréchiga assumed the presidency of the organization in 1999. For additional information about ACAL, contact Latin American Academy of Sciences, c/o Instituto de Estudios Avanzados (IDEA), Apartado Postal 17606, Caracas 1015A, Venezuela; phone: +582 962 1603; fax: +582 976 3490; e-mail: acal@conicit.ve.

PAL RECEIVES AWARD

• The Iranian Research Organization for Science and Technology (IROST) has selected TWAS Fellow (1999) **Sankar Pal** as a winner of the 14th Khwarizimi International Award. The prize ceremony took place in Tehran on 5 February 2001. The annual award, which carries a cash prize of up to US\$5000, affords recognition to scientists who have made significant contributions to a broad range of fields, including agriculture, the basic sciences, engineering and the humanities. Pal, a distinguished sci-



Sankar Pal

entist and head of the machine intelligence unit at the Indian Statistical Institute in Calcutta, is an internationally recognized re-



searcher in the fields of pattern recognition, machine learning and image processing. His studies have shed light on the development of advanced computer systems and neuro-fuzzy intelligent systems for diagnoses of skeletal and cancerous growth. Pal, who has conducted research in India, the United States and China, received his undergraduate degree in physics from Calcutta University and his doctorate degree from Imperial College in the United Kingdom.

PALIS PRAISED

• Brazilian-born **Jacob Palis** (Twas Secretary General) has recently been awarded the Carlos Chagas Filho Award from the state of Rio de Janeiro in Brazil. The prize is named in honour of TWAS Founding Fellow Carlos Chagas Filho. He has also been elected to the Mexican Academy of Sciences and has been granted an honorary doctorate from the University of Santiago de Chile. Palis is the Director of the Instituto de Matemática Pura e Aplicada (IMPA), Rio de Janeiro, and President of the International Mathematical Union (1999-2002). He also serves on the Scientific Council of the Abdus Salam International Centre for Theoretical Physics (ICTP), Trieste, Italy, and was Vice President of the International Council for Science (ICSU) from 1996-1999. He has received numerous awards, including the TWAS Mathematics Prize (1988), Brazilian National Prize for Science and Technology (1990), Brazilian Order of Scientific Merit (1994), Interamerican Prize for

Science (1995). Palis's major research fields are dynamical systems and differential equations.

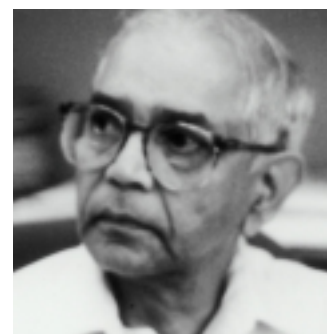
SPATIAL INFORMATION

• TWAS has agreed to become a cooperating organization for the upcoming **Third International Conference on Geospatial Information in Agriculture and Forestry** to be held in Denver, Colorado, USA, between 5-7 November 2001. The conference, which is expected to attract more than 250 participants from industry, government and academy, will focus on applying geospatial information technologies to real-world problems in agriculture and forestry. Among the topics to be addressed are forest fire prediction and modeling, forest inventory and health, crop modeling and yield assessment, natural resource management, multiple uses of forest land, and GIS technology and use. For additional information, please contact Veridan Systems International Conferences, PO Box 134008, Ann Arbor, MI, USA 48113-4008; phone: + 1 734 994 1200, ext. 3350; fax + 1 734 994 5123, e-mail: wallman@erim-int.com.

C.R. RAO HONOURED AGAIN

• TWAS Founding Fellow **C.R. Rao**, who holds the Eberly Family Chair in Statistics and directs the Center for Multivariate Analysis at Pennsylvania State University, USA, has received the Padma Vibhushan award in recognition of his exceptional and distinguished service in the fields of science, engineering and statistics. The award is the sec-

ond-highest civilian honour bestowed by India. Harvard University's eminent economist John Kenneth Galbraith, who is also a former U.S. ambassador to India, was a co-recipient of the award. In addition, Rao recently received the Sankhyiki Bhushan award from the Indian Society of Agricultural Statistics and the Lifetime Achievement Award



C.R. Rao

from the International Indian Statistical Association. In a long and distinguished career, Rao is widely considered one of the true pioneers of modern statistical research and has been internationally recognized time and again for his work as a mathematician, scientist and teacher. His contributions to mathematics and statistical theory and applications have been incorporated as key components of courses in statistics, econometrics, electrical engineering and many other disciplines and sub-disciplines at universities throughout the world.

WHAT'S TWAS?

THE THIRD WORLD ACADEMY OF SCIENCES (TWAS) IS AN AUTONOMOUS INTERNATIONAL ORGANIZATION THAT PROMOTES SCIENTIFIC CAPACITY AND EXCELLENCE IN THE SOUTH. FOUNDED IN 1983 BY A GROUP OF EMINENT SCIENTISTS UNDER THE LEADERSHIP OF THE LATE NOBEL LAUREATE ABDUS SALAM OF PAKISTAN, TWAS WAS OFFICIALLY LAUNCHED IN TRIESTE, ITALY, IN 1985 BY THE SECRETARY GENERAL OF THE UNITED NATIONS.

At present, TWAS has 588 members from 75 countries, 62 of which are developing countries. A Council of 14 members is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a small secretariat of 9 persons, headed by the Executive Director. The secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. UNESCO is responsible for the administration of TWAS funds and staff. A major portion of TWAS funding is provided by the Ministry of Foreign Affairs of Italy.

The main objectives of TWAS are to:

- Recognize, support and promote excellence in scientific research in the South.
- Provide promising scientists in the South with research facilities necessary for the advancement of their work.
- Facilitate contacts between individual scientists and institutions in the South.
- Encourage South-North cooperation between individuals and centres of scholarship.

TWAS was instrumental in the establishment in 1988 of the Third World Network of Scientific Organizations (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: www.twas-online.org

FELLOWSHIPS

Want to spend some time at a research institution in another developing country? Investigate the South-South Fellowships: .../SS-fellowships_form.html

GRANTS

Need funding for your research project? Take a look at the TWAS Research Grants: .../RG_form.html
TWNISO runs a similar scheme, for projects carried out in collaboration with institutions in other countries in the South: www.twonso.org

EQUIPMENT

But that's not all TWAS has to offer. For instance, do you need a minor spare part for some of your laboratory equipment, no big deal, really, but you just can't get it anywhere locally? Well, TWAS can help: .../SP_form.html

TRAVEL

Would you like to invite an eminent scholar to your institution, but need funding for his/her travel? Examine these pages, then: .../Lect_form.html
.../Prof.html

CONFERENCES

You're organizing a scientific conference and would like to involve young scientists from the region? You may find what you are looking for here: .../SM_form.html