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The Third World Academy of Sciences

newsletter

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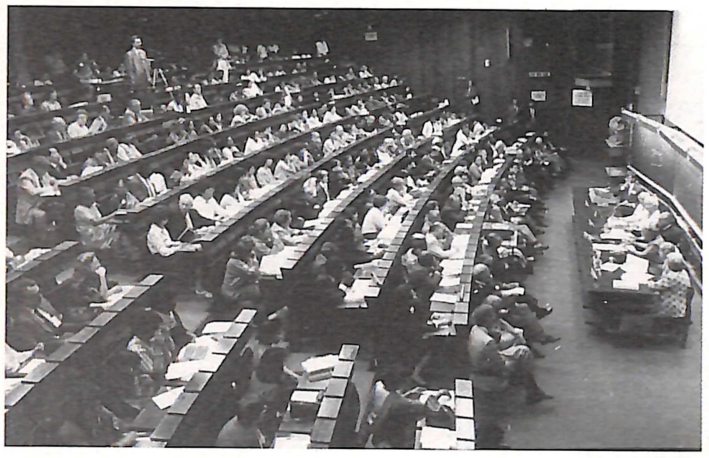

Glimpses of the inaugural session of the Conference on the Role of Women in the Development of Science and Technology in the Third World.

Third World Women Scientists Meet

"Frailty, thy name is woman!" So said William Shakespeare. Did he err in his futuristic perception? To a certain degree, yes!

Giving some measure of their strength, 250 female scientists from distant lands and diverse cultures, from the Caribbean to the Ivory Coast, recently demonstrated that women are among the leading new forces on the international scene. With infectious enthusiasm, they participated in what happened to be the first-ever conference on the "Role of Women in the Development of Science and Technology in the Third World" at Trieste, Italy, from 3-7 October 1988.

The presence of two women Nobel Laureates — Professor Dorothy Crowfoot Hodgkin (United Kingdom, Nobel Laureate, Chemistry, 1964) and Professor Rita Levi-Montalcini (Italy, Nobel Laureate, Medicine, 1986) — vividly testified to the global intellectual strength of the fair sex. Had Shakespeare been a witness to the five-day hectic goings, he could have felt prone to reword another of his famous sayings thus, "What a piece of work is a (wo)man!"

The Conference was convened by the Canadian International Development Agency and the Third World Academy of Sciences. For many participants, the Conference proved a stimulating experience, an opportune concourse to forge new links, not only regionally or internationally, but, in some cases, at the national level, to help in the development of Networks — both in discipline clusters and on a regional basis. The participants were also able to recognize their strength in terms of numbers and achievements,

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Third World Network of Scientific Organizations Holds First Meeting

One hundred and twenty invitees including 44 Ministers, Heads of Scientific Research Councils, and Presidents of Academies of Science from 36 developing countries met in Trieste (Italy) from 4-6 October to take the momentous decision of forming the Third World Network of Scientific Organizations (TWNSO). They succeeded in accomplishing what the United Nations and its science-sponsoring agencies have found an elusive goal for over four decades now.

The presence of Latin American, African and Asian Ministers responsible for science promotion in their respective countries, and their involvement in future developmental activity, is seen as a good omen for Third World science. "Much would depend on the Ministers themselves," said Professor

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especially valuable for young scientists working either alone or as a part of a small minority of women. They uniformly felt the urgency of developing an 'inventory' of Third World scientists to initiate South-South collaborative links, and agreed to form an interim study group to elaborate on the detailed objectives and work plans for an Association of Third World Women Scientists.

The Conference, in the words of Dr. J. Wardlaw, Chairman, Board of Governors, International Development Research Centre, *"will be viewed as a landmark... It should be helpful in terms of promotion of women scientists to bodies such as the Third World Academy of Sciences."*

From left: Ronald Léger, César Lattes, Faroukh El-Baz and David King.

The Woman Scientist

What is special about being a woman scientist? Does she have a different perspective, so different that it will make a difference to science or to decision-making in science? The five-day discussions served the answer. The majority of women do see and feel reality in a way different from most men; of course there are exceptions. But because of gender and because of historical and social compulsions, women tend to view the world in a more holistic way and more spontaneously see and feel inter-dependence. They also have the capacity to create bridges more easily than empires, hierarchies and walls, opined Ronald Léger, Director, NGO Division, Canadian International Development Agency.

"If we agree that one of the objectives of science is the pursuit of truth for its own sake, we must also agree that there are different ways and methods of searching for truth. We may also say that, in general, men and women have *different* ways of searching for this truth... I submit that, with the insight and leadership of women, the agenda for and approach to science can be modified, in fact, elevated, to focus on improvements in the quality of life. This would include the intellectual satisfaction of pursuing knowledge for truth's sake and helping improve the quality of life for the majority of humanity...", the perceptive Canadian remarked to the accompanying applause of the Conference participants.

More women in all fields of science, Léger felt, will probably usher a new scientific era, nay, a new kind of science that recognizes the validity of a different approach. And inducting more women is *not a feminist issue;* it is one of *justice* and of making intelligent use of talents and experience. "The prospect of their full participation in society at all levels is one of the main hopes for a better order in world affairs", the argument was succinctly underscored by Senator Susanna Agnelli (Italy) who inaugurated the Conference.

A report filed by Judith Geiger, who attended the Conference as a TWAS observer, follows.

The goals of the Conference were: (1) to identify and bring to light achievements of women in various scientific and technological areas; (2) to review the status of women in science from the individual countries; and (3) to formulate recommendations concerning an improved and increased role for women in the development of science.

The Conference was organized in plenary sessions with all present, as well as in small group round table discussions.

In the plenary sessions, a wide range of topics were presented, including personal accounts of women's careers as scientists detailing their struggles and triumphs; technical reports on women's research projects, and statistical studies on women's status in Science and Technology in their respective countries. There were also presentations by representatives of international scientific organizations and an overview of the social perspective of Women in Science.

The round tables were held on three afternoons. The first round table session was by regions: Asian, Arab, African; and Latin America and the Caribbean. The second and third round table sessions were divided by disciplinary clusters: Physical, Chemical, Mathematical Sciences; Biological, Medical Sciences; Agricultural Sciences; Earth, Environmental Sciences and Natural Resources. Two additional clusters on Social Sciences and Science and Technology for Rural Developments were added at the request of participants.

In her inaugural address, Senator Susanna Agnelli of Italy light-heartedly remarked, "as this year's awards all went to men, perhaps Professor Salam should give next year's awards to women". After the applause and the laughter had died down, she took a se-

rious note reminding all present that "science and technology should build bridges between different people and countries to work for peace and prosperity". Nobel Laureate Professor Dorothy Crowfoot Hodgkin of the U.K. recounted her achievements and strivings and the influences in her early years that facilitated her continuing on in a predominantly male area of science. Nobel Laureate Professor Rita Levi-Montalcini of Italy gave a brief history of famous women scientists who are usually not represented in science history books, which perpetuates the myth that women are not equal to men in mental capacity. She made the edifying comment, "Men invented war, women must invent peace".

Fifteen reports on the Status of Women Scientists in the Third World countries were presented in plenary sessions. A few interesting revelations: In Argentina, 51% of present day university graduates are women compared to 14% in 1957, yet, only 9% of the faculty are women. Dr. Christiane Dosne Pasqualini described her thirty-year biomedicine career during which she raised five children. She attributed her success to her considerate husband as well as generous household help. She said, "A woman cannot put 100% into her scientific work because of family needs thus she has less time and concentration for work and publishing. The most difficult part for women scientists is discipline because they very often are trying to balance their scientific careers vs household ones".

Dr. Xie Xide of China reported that prior to 1948 women, as well as most men, had little or no opportunity to study science. Today, all enjoy an equal chance to attend university. She stated that in terms of numbers women still lagged behind men in some fields of science and technology (only 10% of the physics graduates are women, whereas biotechnology and biology are most popular with women). The reason for this is the career vs household work. Women in China are still expected to take care of the children and household chores and that many employers are not keen to hire women because of the mandated three month maternity leave. Dr. Xie Xide stated that with diligence and devotion the number of women scientsts will multiply and the situation retrieved. There are already some hopeful portents: at an oil field, one out of every four engineers and one out of every two technicians is a woman.

Dr. Farkhonda Hassan (Egypt) informed the participants that before 1952 there were only a few women in science and engineering, but after 1956, the constitution gave women equal rights with the result that their numbers increased. Today, they enjoy equal access to the university and there is a higher number of women in education than ever before. She stated that there is little resistance from society towards women who take this path but that there are still very few women participating at national policy making level.

Professor A.A. Andam (Ghana) reminded the gathering that if the Third World earnestly desired industrial development, it must refrain from ignoring the potential of its female population. At present, Science is a mandatory subject for secondary school students and they must sit examinations. At the University level, 10% of chemistry and physics students are females, while they make up 5% in mathematical studies and 80% in biology. Two reasons for the relatively low numbers in chemistry, physics and mathematics are the phenomena of "math phobia" which affects school girls at a very early age, discouraging them from chosing these subjects. The other reason is the fear of missing the "marriage boat" which takes many students out of graduate programmes. Two approaches to retrieve the situation are: (1) single sex secondary schools where girls are free from harassment from male students on their interest in supposedly male subjects, (2) organization of 'science clinics' to help girls both in their studies and to provide role models of women scientists.

An emotional address was given by Professor E.A. Bari (Sudan). She stated, "I don't think that our problem is like anybody else's". 1945 was the first year women entered the university. The 1960's witnessed a boom of female students. Regretfully, women scientists face a social stigma in that they find it difficult to get jobs. *"Our problem is not the education of women, our problem is the education of men.* We are a hybrid nation, with over 500 dialects, ravaged by civil war, famine, drought and floods", Professor Bari said. She appealed to the women of the world to focus on the women in Sudan so that they can see just how op-

Italian Nobel Laureate Rita Levi-Montalcini and TWAS Executive Secretary Mohamed H.A. Hassan

pressed and depressed they are. She asked the women scientists from around the world "to stand by them and save them from drowning".

Scientists in Jamaica were not discriminated if they happened to belong to the female gender; the problems faced by the scientific communitywere incidental to all, and women as well as men shared the problems of lack of funding, materials and facilities.

The ten scientific lectures presented at the Conference were an important part of the programme. These were enthusiastically received resulting in long question/answer sessions prompting the Chairpersons to suggest discussions to continue during free time. Indeed, small group discussions continued during coffee breaks, dinner, and often in the late evening hours.

An example of such scientific presentations was a talk by Professor Hu Qiheng of China, who spoke on the history of Artificial Intelligence and problems of recognition in China, and Professor S.A. Temtamy of Egypt who, before explaining her interesting research on Human Genetics, gave an overview of her illustrious career which was sure to inspire the many young women scientists present. She told the audience that 75% of all birth defects occur in the Third World and that only 25% of these are genetic. Dr. D.W. Zewdie of Ethiopia reported on the challenge of AIDS in her country. She gave a detailed description of the steps taken by the government to combat and control the deadly disease.

The Conference was also addressed by representatives of different international scientific organizations. Histories, activities and philosophies of the organizations were detailed. It was pointed out that this was the first time that such a large and diverse group of women scientists from the Third World had assembled. Suggestions for methods of networking were presented. Ms. J. Pratt of the World Bank told the audience that "they must not be ashamed any more, and should not apologize for hiring women".

The general assembly was also addressed on the Social Aspects of Women in Science. Professor S. Widnall, President of the American Association for the Advancement of Science, stated that when she joined the faculty of the MIT in1964, there were only 3 women professors. Today, there are over 100 out of 950. Elizabeth Mann Borgese followed by saying that although this certainly marks an increase, the women of today are still expected (by society) to put their family before their career. She also said that "as long as women put their scientific careers second to the family, there will be no equality in science. The same can be applied towards sharing of responsibilities with men". She regretfully noted that the women scientists of the North have nothing to offer to those of the South in terms of role models.

The *round table sessions by regions* gave the participants an opportunity to compare and contrast the status of women in their regions. Ideas were introduced on recommendations for each region and reports submitted to the Conference Steering Committee. In each of the regional round tables, the Chairperson had a suggested list of items given by the Conference organizers to cover. The list consisted of detailing problems of women scientists in the region, to come up with recommendations for improvements, and to discuss the issue of the possible formation of an Association for Women Scientists of the Third World.

In each regional group, a number of papers (between 10 to 15) were presented on the status of women scientists and technologists in their respective countries, as well as reports on scientific research. These were followed by lively discussions to identify similar problems, their sources and to define methods and means of overcoming them.

Most of the identified problems were common to all of the regions and could be enumerated as follows:

- Small numbers of women in physics, chemistry, mathematics and engineering;
- The pressure to marry and have children;
- The traditional role of women in the family structure;
- Lack of productivity and publications;
- Primary level gender stereo-typed education in textbooks and games;
- Lack of women at policy making level;
- Lack of women science teachers at primary and secondary levels;
- "Math phobia" in young girls;
- Political change, isolation, lack of recognition;
- Lack of proper funding, infrastructure and materials.

While all regions shared these common problems, some were unique to a region. In Africa, it was noted that in many areas there is still no formal education for girls. In the Arab region it was brought forth that the gap between the

Janet Wardlaw and Rita Levi-Montalcini

minority of the educated and the majority of the illiterate was vast. In Latin America and the Caribbean, it was pointed out that there was no gender discrimination in scientific research *per se,* instead, men and women shared similar problems. In Asia, it was argued that women must have the full support of their husbands and that no law passed would accomplish this. Many of the recommendations for change were shared by the different regions:

- To popularize and promote science and teaching at all levels;
- To do research aimed at the application of Science and Technology in rural areas, and to find solutions to such problems as health, nourishment, population explosion, etc.;
- To seek political and other high level decision/policy-making positions;
- More incentives for women scientists such as higher salary, more opportunities for scholarships, fellowships, awards;
- Better service conditions for women scientists, such as day care for children;
- An inventory of bio-data of women scientists should be prepared in each country and made available internationally.

The Asian, African and Arab regions were all in support of forming an Association for Women Scientists after concrete objectives had been decided upon. These three regions were also in favour of organizing regional associations and meetings. The Asian and the African group both addressed the need for more participants in South-South and South-North projects and exchanges, as well as the need for international agencies to support women scientists. The African report is five pages long and includes many recommendations. The vast majority of those present at the Latin American and the Caribbean region group felt that the formation of such an association may be premature and perhaps inopportune.

The round tables by *scientific disciplines* met twice on consecutive afternoons (except for the group on Science and Technology for rural development which met only once). The system used was similar to that during the regional group sessions except that more time was allotted to presentations and less to discussion. Over 60 scientists attended the session on Biological and Medical Sciences with 28 oral presentations and one presentation as a poster. About 25 scientists attended the round table on Physical, Chemical and Mathematical Sciences. About 20 participated in the Earth and Environmental Sciences and Natural Resources group. There were 15 participants in the Agricultural Science session with 10 presenting papers. The Social Sciences group had about 25 participants. In the session on Science and Technology for Rural Development there were 28 participants.

Different cultures, diverse backgrounds, but common goals.

Each group made a list of recommendations relevant to its specific discipline. Below are a few examples from each discipline:

Biological and Medical Sciences

- At future conferences specific themes related to Third World development problems (especially nutrition, reproduction, health research and education) be designated, poster sessions be used to save time, and eminent scientists be invited to speak for a wider exposure to current knowledge;
- To make a directory of Women Scientists in the Third World;
- To institute fellowships for young women scientists whereby they would work in fully equipped and developed laboratories to gain experience and to learn new technologies.

Physical, Chemical and Mathematical Sciences

- The eradication of gender discrimination in teaching, textbooks, toys and games;
- Young women scientists should make an active contact with young students to provide role models and to encourage students to pursue these subjects;
- TWAS should play an active role in encouraging its member countries to improve the curricula and methodology of instruction at the school level in these subjects.

Earth and Environmental Sciences and Natural Resources

- The use of biocontrol and biodegration to be introduced to manage wastes as well as national and regional education programmes on energy conservation to be implemented;
- The protection of endangered ecosystems and species be emphasized, non-contaminating technologies be used in solving environmental problems, and the Third World protected from the dumping of toxic and other wastes from developed countries;
- A Centre for Environmental Studies be created as a branch of TWAS.

Agricultural Sciences

- At future conferences more women scientists should be invited in the area of Food Sciences and Technology (only one was present);

• Women in Forestry Science should also be invited in future.

Social Sciences

• To use a multidisciplinary approach to problem-solving, wherever applicable, between the Social and the Natural Sciences;

• In addition to an international databank on women scientists, an objective report on each scientist detailing her personal experience in attaining the present position with details of obstacles and how she overcame them should be prepared. This data should be pooled and analyzed to help future generations of women scientists;

• Participation of women scientists in the development of the Third World cannot be discussed with out recognition of human rights and fundamental liberties.

Science and Technology for Rural Development

• To organize regional meetings for exchange of information/experience and to bring about a greater interaction between women scientists and technologists, technology developers and users, at periodic intervals in different developing countries;

• To ensure government policies to be more supportive on a long term basis to facilitate the work of women scientists in the development of rural areas through more subsidies (fiscal incentives, infrastructure, support of an interdisciplinary approach, between government departments/ NGO's/ village level organizations);

• To give women scientists and technologists greater recognition for their work in rural areas.

On the last morning of the Conference, Professor Abdus Salam, President of TWAS, spoke to the participants as they were preparing a debate on the question of forming an Association for Women Scientists in the Third World. He said that "those who are rich in something should help those who are not". After his speech, a lively debate ensued, with speakers voicing their opinions for or against the im-

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Inaugural Address by Sen. Susanna Agnelli

I wish to thank the Third World Academy of Sciences for the kind invitation to open the Conference on the Role of Women in the Development of Science and Technology in the Third World. On behalf of the Government of Italy and in particular of our Minister of Foreign Affairs, Mr. Giulio Andreotti, may I express the warmest welcome to all participants in this Conference and wish you a profitable meeting and a stimulating exchange of experiences and ideas. It seems to be meaningful that the Conference takes place here at the International Centre for Theoretical Physics in Trieste, a city which is a main crossroads of different cultures.

The Conference which opens today tackles three different subjects: the role of women, the development of science and technology and the general situation of the Third World. Each of these problems has its own specificity; your work, in the next days, is to analyze the interaction between these three elements. It is a task which might be taken for granted but its relevance must be nevertheless underlined. If on one hand we observe an increased awareness of the need to improve the role of women in the development of society, therefore also of science and technology, on the other hand we still notice a gap between these commitments and reality. Indeed a lot remains to be done for women, for science and technology, for the Third World. We are glad to receive contributions of scientists and experts from many countries of all continents and we will carefully consider their recommendations. We also know that their success will depend on how clearly we define the problems.

As you might know, the United Nations estimated that women, although constituting just over half of the world's population, perform nearly two-thirds of the world's labour. On the other hand women only receive one-tenth of its income and own less than one-hundredth of its property. These numbers represent the undeniable fact that, globally, women have had much less access to education and vocational training.

On this alarming background we face today's topic, or topics, on the agenda. Let me first refer to the United Nations' Decade for Women, that culminated with the 1985 Nairobi Conference. The Decade was concerned with the issue of economic equality and independence of women, as well as their full integration into the decision-making processes of society. The Decade had a major impact in raising awareness of the position of women and gaining Government commitment to address their needs. Women, particularly in the Third World, have since been recognised as the major working subjects in agriculture and health.

Everywhere they are beginning to work increasingly in non-traditional sectors such as industry, trade, marketing and services. It is well-known that this important contribution from women, is too often undervalued by our system.

I believe, in any case, that sensitivity on the role of women in the development of the Third World is rapidly increasing everywhere. In Italy, for example, we wanted to characterize the interventions and programmes of co-operation with Third World countries in accordance with the interests and the expectations of the female population. As a result we passed a law that imposes to verify whether our interventions effectively meet their needs. Naturally problems are not solved by laws alone. They can stimulate a specific action but surely not define it fully. In order to do so, concrete developments are needed on the field. And it seems to me that the experience of these last years helps us to better

understand the limitations of a mere set of rules which, even if inspired by the best intentions, ends up by being useless or even worse, counter-productive.

There is another aspect which to my mind deserves the greatest attention. In these last years the awareness of the interdependence between economic and social developments at an international level has increased. The concept of interdependence, unthinkable until a few years ago, is now a fundamental criteria in our relationship with the Third World. If we acknowledge this economic interdependence, the same will have to take place in science and technology.

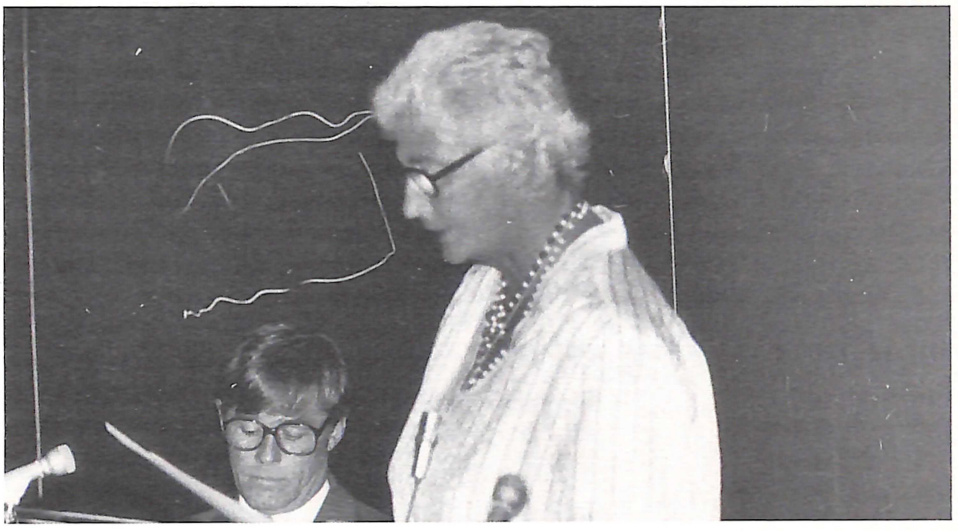
The example of AIDS seems to reflect clearly this simple truth, namely that the need to cooperate and to exchange scientific and technological knowledge is a very concrete and current need.

In this context we support, as it is well known, regional integration between neighbouring countries. In Europe this implies on a general basis, a wider circulation of people and ideas. And if we think about science and technology we feel that in these areas integration and free exchange of information can take place even more rapidly than in other fields.

Scientists are united, independently from the level of development of their countries, by an identical calling for progress and for the best use of resources. In this sense science and technology can play a very important political role, that is to build bridges between different systems and different countries, for the common goal of peace and progress. The vital condition for this to happen is the recognition of the freedom of movement and of the freedom of expression, without barriers or limitations. Women's commitment, not only in the Third World, will have to be that of channelling in this process the best of their experience, of their culture and of their particular sensitivity. Women are among the leading new forces on the international scene. The prospect of their full participation in society at all levels is one of the main hopes for a better order in world affairs.

Women in Science and Technology: Challenges to a New Scientific Approach

Opening Remarks by Ronald Léger, Director, International NGO Division Canadian International Development Agency (CIDA)



Ronald Léger and Sen. Susanna Agnelli.

I am honoured to be part of such a special gathering of women and men at the forefront of science and development. As a Canadian, I am proud that CIDA is collaborating with the Third World Academy of Sciences to make this Conference possible, which, by the way, opens on the same day as Canada's first publicly declared "Development Day". I am especially happy to see so many women from so many countries, cultures and scientific disciplines assembled to promote the role of women in science and technology in the Third World.

In 1984, here in Trieste, I encouraged my friend Abdus Salam to pursue his vision of a special network to honour, promote and strengthen Third World science and technology. One year later, this twinkle in the eye became the Third World Academy of Sciences. I am especially proud to have contributed to its realization and that CIDA was the first to support this unique group. Not only does it give recognition to Third World achievements, but it is also showing remarkable leadership in promoting and stimulating innovation and excellence among thousands of Third World scientists.

Soon after the Academy became a reality, Abdus Salam and I were debating the issue of science and gender, and how the Academy could respond to the challenge of increasing the involvement of women scientists. We agreed that we did not know how to do that very well. It finally dawned on us to encourage a small group of women scientists to help. This meeting is the result of the organizing committee's work over the past year.

Therefore, you are here not only because you are scientists, but because you are women.

So, what is special about being a woman scientist? Do you think so differently that it will make a difference to science or to decision-making in science? Because of your gender, do you have another approach to the universe, another outlook, other methods? Do you have something special and different to contribute? If so, what and how? These are some of the issues you will be discussing this week.

I will limit my remarks here to the following theme: the special strengths, qualities and insights women bring to the scientific approach, especially for the three-quarters of humanity living in the Third World.

I believe the majority of women do see and feel reality in a way different from most men; of course, there are exceptions. But because of gender and because of historical and social conditions, I believe women tend to view the world in a more holistic way and more spontaneously see and feel inter-dependence. They also have the capacity to create bridges more easily than empires, hierarchies and walls.

From a development point of view, you are part of the 50% of humanity that has been and still is treated as a minority with fewer real rights and opportunities than men, but with greater responsibilities regarding future generations.

As Third World women, you play an important role in development. You provide half the food, fetch most of the fire wood, and carry most of the world's produce, raise all the children. Above all, you are the main educators and health providers of the young, boys as well as girls; yet you make up 500 million of the 800 million illiterates in the world and are the last to receive training opportunities.

Furthermore, you work 2/3 of working hours, receive 1/10 of income and own a mere 1% of property. Your unrecorded and unpaid work is actually a huge invisible subsidy for the world's formal economy, worth at least 4 trillion dollars, or up to 20-30% of global GNP.

"Modern" science and technology has largely been shaped by Western male minds. The result, to be blunt, is that more than half of all the world's research resources are devoted to improving weapons which threaten our very existence, and 2/3 of the remainder to marginal changes in esoteric or non-essential goods.

True enough, western science and technology have done much to improve conditions in the Third World, especially in areas such as health and agriculture. *But real improvements in the Third World have largely been a result of these countries' own efforts. In the past generation, the people of the Third World have come further and faster through their own sweat and toil than Western societies ever did at comparable stages of development.*

A major theme which has influenced our thoughts and actions since the origin of "modern" science has been that men could dominate nature. This belief has pervaded scientific enquiry for a long time and has conditioned much of the technology that has flowed from it.

However, this belief is not itself scientifically grounded, as we are now discovering. Belief in our power over nature has been responsible for major discoveries, true enough, but it has also been the root of many of our present-day global perils such as ecological imbalance, famine and desertification.

Another myth of modern science has been that the pursuit of scientifically valid knowledge must be carried out only through objective enquiry. One of the consequences of this approach has been that men and women who do not conform to this vision are discouraged from embracing the scientific vocation.

It has also been said that one of the objectives of science is the pursuit of truth for its own sake. Now, if we agree with this, we must also agree that there are different ways and methods of searching for truth. We may also say that, in general, men and women have different ways of searching for this truth. This very difference is an asset often underestimated.

If we take this different approach into account, research will become more fertile in all areas of human enquiry, but especially in such important areas as environment, population, basic health and food production. These areas call upon science and technology and by their very nature demand networking and multi-disciplinary approaches.

I submit that, with the insight and leadership of women, the agenda for and approach to science can be modified, in fact elevated, to focus on improvements in the quality of life. This would include the intellectual satisfaction of pursuing knowledge for truth's sake, as well as the moral satisfaction and practical achievement of helping to improve the quality of life for the majority of humanity.

The pressing problems of our times, both in the North and South are related to the respect of nature, and to basic human needs such as food and health, as well as self-esteem and a sense of purpose. Because of gender and socialization, there are problems that women can more easily relate to than most men. To begin to tackle such problems, the world needs more women scientists.

More women in all fields of science will probably introduce a new scientific era, maybe even a new kind of science that recognizes the validity of a different approach. Above all, we need to place more emphasis on certain nurturing roles — as in health and the concept of sustainable development.

In order for women to truly make their mark in science, they must apply their particular strengths and promote their own gender — not against men, but together with them — to give power to and enable women to influence decision-making in scientific and technological fields, and to encourage young women to enter this important world. Giving power to women, especially young women, means giving them recognition and opportunities — not gifts or handouts — and doing this in a proactive way primarily through education and leadership.

It is not necessary for women to wait until they reach a critical mass in all fields of science and technology in order to promote changes. Women can

I am proud to have participated in the Conference on the Role of Women in the Development of Science and Technology in the Third World and in the sessions of the Third World Network of Scientific Organizations. I feel that between October 3 and 7, 1988 in Trieste, I had been a part of two important historical events that will give confidence to Third World Nations and will help to change Northern attitudes towards science and technology in developing countries.

and should organize now to influence decision-making where it counts, at the policy level of influential organizations, universities and government departments. This could make a difference in important science-related fields, such as technology, ecology, agriculture, health, education and planning.

I encourage you to promote excellence of achievement of young women in these fields, and to insist on adequate and equal representation in professional associations. Mobilize funds to create opportunities and positions for women in all key scientific areas, including the theoretical and basic sciences.

Women in science is not only a scientific issue, it is a social and political one. Women by their work and toil are already responsible for most of the survival technologies related to food, health and basic training. You owe it to yourselves and to humankind to orient science and technology toward important and basic needs, and away from the present imbalance — our bizarre emphasis on weapons and luxury goods.

In summary, I believe that women scientists today can make an important contribution to science and to development, especially in Third World countries. The works of many great women scientists — in fields ranging from nuclear fission to ecology — while major contributions to science, did not substantially improve the representation of women in the decision-making process. Women who came after them could only look up in distant admiration. When it came to influencing priority-setting and the allocation of resources in science, women were scarcely more advanced than before.

I believe that the question of more women at all levels of decision-making in the field of science and technology is not a feminist issue; it is one of justice and of making intelligent use of talents and experience. Therefore, because of their special perspective and because it is right, women must be involved in all levels of strategic planning for the very allocation of resources for science and technology.

If physical gravity in a critical mass can "bend light", as Einstein theorized, then the social gravity of women's leadership at strategic points and times can bend political will.

Ronald Léger's Closing Remarks

It is an honour to share with you a few closing remarks in the presence of my friends, Mrs. Makhubu and Abdus Salam. Their leadership and foresight represent the organizing forces behind this conference which, through your participation and dynamism, has been transformed into an international event.

Parallelism with the TWAS Experience

The parallelism is striking between some opinions heard this week in Trieste and those expressed prior to the creation of the Third World Academy of Sciences (TWAS) in 1985. Some have been asking: What is the purpose of a network of Third World women in the field of science and technology?

Before TWAS was born, many western scientists, scientific associations and funding agencies did not see the purpose or the usefulness of creating a special association for the promotion of Third World scientific efforts. Many doubted the existence of outstanding achievements in the Third World that were not already being addressed by existing international bodies. A few Third World scientists also hesitated, since they were already members of internationally renowned academies or associations.

A mere three years after the creation of TWAS, who would now question its purpose or doubt its usefulness? For the few Third World scientists who were already members of renowned academies, or who were doing research in modern, sophisticated labs, it has not brought new recognition, nor direct assistance, although it has brought new pride. However, to the vast majority of Third World scientists, it has brought significant changes to their work. For them, TWAS has meant spare parts for a lab, or travel grants and South-South exchanges for young scientists, or a subscription to a scientific journal for an isolated scientist. Above all, TWAS has meant a new hope for science and technology in developing countries.

TWAS also concentrates much of its efforts on the organization of scientific conferences and workshops on key development issues, and on the promotion of networks and exchanges. For October-November 1988 alone, the list of promising initiatives is impressive:

- October 3-7: This Conference on the Role of Women in Science and Technology... and the creation of a new Network, within TWAS, of Third World Scientific Organizations.
- October 31 - November 1: Workshop on the flow of scientific literature to Third World institutions, with the participation of major scientific publishing houses.
- November 2: Workshop for an inventory of scientific institutions in the Third World.

We know now that the Academy's efforts to support Third World scientific work and give proper recognition to Third World achievements is important. In its brief existence, TWAS has made a significant contribution to the promotion of science and technology in developing countries, and has given new hope to Third World scientists. The young Academy has also established useful linkages with the major international scientific academies, institutions and centres, and has helped these to focus more of their attention on specific needs and problems of the Third World.

A Remarkable Event

In the same way, this gathering of Third World women scientists is breaking new ground and could lead to important changes in the future development of science and technology in developing countries.

This gathering is remarkable for its size, over 250 women scientists from 65 countries, for the level of credentials, and for the quality of scientific presentations. I am informed that, in the past, when asked to submit names and credentials for various TWAS activities, national scientific organizations proposed lists composed almost entirely of male scientists. When invited to submit names for this all-women scientists' conference, these same organi-

zations proposed over 500 names of women scientists whose credentials, according to the TWAS Secretariat, were on average even more impressive than those of their male colleagues usually invited to such events. This week, I attended workshops pertaining to both this conference and the Network of Third World Organizations. The quality of the presentations in both cases was impressive; some were outstanding, and deserve a wide distribution.

Women Scientists, Special Needs and Strengths

My own conclusions are that Third World women scientists have special needs, problems and priorities, as well as special strengths that they can bring to bear in the scientific world. Of course, their situation varies from country to country. For example, the scientific milieu in countries like Brazil, Mexico, China and India, where women are present in significant numbers, is different from the situation in countries such as Mozambique... which has only 14 PhD's, three of whom are women... or the Sudan, which has only 5 or 6 women scientists. These differences, however, make South-South solidarity and exchange all the more enriching, even necessary. I believe that women scientists from developing countries can benefit from coming together and promoting their gender in scientific fields. Society as a whole will also benefit.

Follow-up: Influencing Decision-Making

CIDA is proud to have collaborated with TWAS to initiate this conference, which your dynamism has transformed into an event. Only you will determine its follow-up in your own countries, regions and within TWAS itself.

The success of this conference will be measured by your own efforts to influence decision-making bodies and institutions in your own countries... and, as suggested by Abdus Salam, by your full participation in the activities of TWAS, especially in the meetings in Colombia next year.

Continued on page 24

TWNSO — Continued from page 1

Abdus Salam, the newly-elected President of TWNSO. "We didn't expect this success though," he added, attributing the consensus on the Network's formation to the participants' faith in the Third World Academy of Sciences (TWAS), the host organization.

Founded in 1983 by Salam and inaugurated by the UN Secretary General in 1985, the Academy's initiatives and programmes are beginning to crystallize and gather steam. Said Dr. J.M. Aminu, Nigerian Minister of Education, "The Academy's impact is being felt in the scientific community."

The emphasis in the TWAS initiatives remains on South-South and South-North collaboration. In the context of South-North relations, the Third World Network of Scientific Organizations has made an auspicious beginning with CIDA, the Canadian International Development Agency, pledging to "consider a special request for support for the Network..." The Italian Government has also promised a contribution of a quarter million dollars.

The formation of TWNSO — the scientific analogue of the Founding of the Group of 77 — deserves to be supported. Its membership stands at 99 today, and is drawn from 59 developing countries. The Network could act as a non-political group, both internally and externally, to espouse the cause of developing country science. The Ministers who participated in the three day meeting pledged to produce results at home, a development Salam did not expect so soon. It is a "bonus" outcome of the TWNSO meeting, he said.

The next meeting of the Network will be held in Colombia during October 1989. Should Dr. Perez be voted into power in Venezuela — he is a great supporter of science and has promised to raise the expenditures in scientific research to 2% of the GNP — a meeting of Latin American heads of state might concurrently take place in Colombia, giving Perez and Salam the chance to impress upon the distinguished gathering the importance of science in national, regional and global development.

Succinctly summing up the three day deliberations, the "Trieste Declaration", read out during the TWNSO conference, stated: "Recognizing the fundamental importance of Science in socio-economic and cultural development and technological progress, and keeping in view the recommendations of the South Commission pertaining to the crucial role of Science in the Third World, as mankind approaches the 21st century, the members of the Third World Network of Scientific Organizations present at the meeting held in Trieste from 4 to 6 October 1988 resolve to work towards giving Science and Technology a position of highest priority in their own countries and to strengthen their collaboration with other countries of the South as well as the North."

According to its statutes, the Network will be a "non-governmental and non-profit making organization." The general objective of the Network has been defined as the promotion of "South-South and South-North Cooperation in the development and application of Science and Technology in the Third World." This could be achieved by (a) furthering the contribution of the South to global projects of science (such as Man and the Biosphere programme of UNESCO and the International Geosphere Biosphere Programme of ICSU); (b) furthering the contribution of the South to areas of today's frontier science and technology which are most likely to have a strong impact on the economic and social development of the Third World (such as space science and technology, thermo-nuclear fusion, high technology and biotechnology); (c) South-South collaboration; (d) South-North collaboration; (e) encouraging Third World Governments to take appropriate political action to develop their scientific enterprise through self-reliance and proper allocation of resources.

The Network will be headed by a President, four Vice-Presidents representing each of the African, Arab, Asian and Latin American regions, and a Secretary General.

Professor Salam's Opening Remarks

It gives me great pleasure to welcome you on behalf of the Third World Academy of Sciences for the First Meeting of the Third World Network of Scientific Organizations.

The Third World Academy of Sciences was founded in 1983 and inaugurated by the Secretary-General of the United Nations Mr J. Pérez de Cuéllar in 1985. It was granted an official status by the United Nations in the same year.

There are currently 151 members of the Academy (106 Fellows and 3 Corresponding Fellows who are distinguished scientists, nationals of Third World countries, and 42 Associate Fellows who are distinguished scientists, either ex-nationals of Third World countries or who have distinguished themselves in the context of Third World Science). Among the membership there are 10 Nobel Laureates of Third World origin and 42 Third World countries are represented in the fellowship of the Academy.

Ever since its inauguration by the Secretary General of the United Nations, the Academy, with generous financial support from the Italian Government, the Canadian International Development Agency and the Kuwait Foundation for the Advancement of Sciences, has been pursing a number of programmes aimed at helping scientists and scientific institutions in Third World countries. These include the awards of Prizes to distinguished scientists working and living in Third World countries. The first set of these awards was given in 1985, the second in 1986 and the third was awarded yesterday to: Professor Cesar Lattes from Brazil (Physics); Professor Chuangtian Chen from China (Chemistry); Professor Adolfo Martinez-Palomo from Mexico (Biology) and Professor Mudumbai Seshachalu Narasimhan from Indian (Mathematics).

We also awarded yesterday the First History of Science Prize, the main purpose of which is to bring to light the scientific achievements of Third World scientists prior to the 20th century whose work has not been hitherto clearly recognized. The Prize was awarded to Professor David King for his essay "Shams Al-Din Al-Khalili and the Culmination of the Islamic Science of Astronomical Timekeeping."

A second programme is the award of research grants of US$5,000 each to promising research work carried out in Third World countries. So far around 300 Research Grants have been made (99 in Biochemistry/Molecular Biology, 138 in Physics and 42 in Mathematics).

A third programme is to enhance South-South collaboration between scientists in the Third World. So far 123 scientists from some 40 countries have been awarded Fellowships to visit institutions in Third World countries. In this context, the Academy is happy that Governments and Scientific Organizations in Argentina, Brazil, Chile, China, Colombia, Ghana, India, Iran, Kenya, Madagascar, Mexico, Vietnam and Zaire have agreed to provide local hospitality for a total of 257 annual visits.

A fourth programme is to support long-term visits by scientists from the Third World to Italian Laboratories. Working in the fields of Biological, Chemical and Geological Sciences, 68 scientists (27 biologists, 34 chemists, 7 geologists) from 26 Third World countries are currently visiting laboratories in Italy. Senator S. Agnelli announced yesterday on behalf of the Italian Government that US$1.6 million will be allotted by the Italian Government to this programme.

A fifth programme is to support scientific meetings in Biological, Chemical and Geological Sciences held in developing countries. We have so far supported 173 meetings held in 47 Third World countries.

Finally, through a sixth programme, we are helping a large number of libraries in Third World countries which badly needed scientific journals and books. Because of its importance, this programme will be discussed in detail within the agenda of the present meeting.

In addition to these regular programmes, the Academy has recently initiated a number of new programmes jointly with other international organizations. Examples of these are:

- The Conference on the "Role of Women in the Development of Science and Technology in the Third World" which is taking place during this week and is organized in collaboration with CIDA;
- A joint lectureship programme in collaboration with ICSU;
- An Associateship Scheme in collaboration with the International Centre of Insect Physiology and Ecology (ICIPE);
- The publication of a Science Journal of the Third World entitled "Discovery and Innovation" in collaboration

A view of the TWNSO meeting.

with the African Academy of Sciences and with financial support from the Kuwait Foundation for the Advancement of Science;

• A Workshop on "Flow of Scientific Literature to Third World Institutions" which is scheduled for 31 October - 1 November 1988 and is organized in collaboration with ICTP, UNESCO and ICSU;

The first Meeting of the Network elected the following members of the *Executive Board* for an interim period of one year:

President:	Prof. Abdus Salam (Pakistan)
Vice Presidents:	Prof. J.M. Aminu (Nigeria, African Region) Prof. B.A.R. Omar (Malaysia, Asian Region) Prof. M.L. Bouguerra (Tunisia, Arab Region) Prof. F. Del Rio (Mexico, Latin American & Caribbean Region)
Secretary General:	Prof. M.H.A. Hassan (Sudan)
Members:	Prof. O.F. Bizri (Syria, Arab Region) Prof. A. Babale (Cameroon, African Region) Prof. Hu Qiheng (China, P.R., Asian Region) Prof. G.V. Taylor (Jamaica, Latin American & Caribbean Region)

In addition, three Standing Committees were formed:

1. **Global Projects:**	Chairman: Prof. C. Pavan (Brazil)
2. **Hazards:**	Chairman: Prof. E.U. Emovon (Nigeria)
3. **Programmes:**	Chairman: Prof. J.M. Aminu (Nigeria)

• The development of an Inventory of Science Institutions in the Third World in collaboration with ICSU and UNCSTD.

The creation of a Network linking Ministries of Science and Technology and Higher Education, plus Academies, plus Research Councils in the Third World, was first proposed by the Third World Academy of Sciences' President at the opening of the TWAS Second General Conference in Beijing, China, in September 1987. The proposal was subsequently discussed and endorsed by the participants of the Conference. At the meeting in Beijing, Sig. Balboni of the *Direzione Generale per la Cooperazione allo Sviluppo* of the Government of Italy, pledged financial support for the Network of a quarter of a million dollars annually. An Ad-hoc Committee, chaired by H.E. Professor J. Aminu, was set up to institute the Network. Since then, 99 Academies, Research Councils and Ministries from 59 Third World countries have joined the Network.

The purpose of the Network is to increase the effectiveness of Science in the South, through collaboration and communication among Ministries of Science and Technology and Higher Scientific Education, Research Councils and Academies. I do not have to stress what collective action can mean in this respect, particularly since Science has become more and more global. The South can then collectively have substantial input in global science programmes and frontiers of science research (examples of these are the ICSU/UNESCO global programmes, the biological studies of the human genome, thermo-nuclear fusion, space research, Marine Science and so on). This will eventually enhance the effectiveness of South-North collaboration in these programmes.

We also wish to discuss the appropriate alert systems for the South for natural man-made hazards, such as desertification, pollution, the greenhouse effect and the dumping of toxic and nuclear waste.

Apart from the Network, the meeting will discuss the global and frontier problems of Science and Technology and governmental involvement in these as well as the whole problem of political

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Professor Jibril M. Aminu's Address

Let me welcome you all most heartily to the First Conference organized to give shape to the embryo of the idea of a Network of Scientific Organizations of the Third World — an idea first conceived of in Beijing during the Second Meeting of the Third World Academy of Sciences in September last year, 1987. I welcome, in particular, the Honourable Ministers of Higher Education and/or Science and Technology as well as the Heads of the National Academies and of Scientific Organizations who have so generously responded to our invitation to attend this meeting. We also welcome all of the distinguished scientists and guests. We feel very encouraged by the warm response given to the invitations sent out for this meeting. At once, I thank Abdus Salam and Dr. Mohamed Hassan, the Executive Secretary of the Third World Academy of Sciences, for their active supportive role since Beijing.

Professors Roche, Menon, Habibie and I were delegated to explore in greater detail the prospects of the idea of a Federation of Scientific Organizations (or Network) gaining acceptance. The Secretariat contacted as many scientific organizations as they could lay their hands on. I addressed a letter to all Ministers of Higher Education and/or Science and Technology in the Third World. This meeting and the rich attendance it portrays, are a clear testimony to the positive response we received. In particular, at least 12 Ministers wrote back expressing their desire to participate, one or two asking for additional information, which, I believe, has now been provided by the excellent write-up from the Secretariat. I express my appreciation to all concerned.

In my address to the Conference of the Academy in Beijing last year, I referred to my belief, which I know I share with many of you here. It is this: the founding of the Third World Academy of Sciences marked a *New Dawn on Earth*. The Academy's objectives of the use of Science and Technology to promote the quality of life in the Third World

and to entrench peace, security and justice on Earth are well articulated. The impact of the Academy, by its presence and its activities, is also being felt in the Scientific Community. Eventually, some of this good work will go down to every man, woman and child in the Third World.

"In the Scientific Community" and "eventually" are words both of hope and of concern. Hope is obvious. Concern is that the effects of the good work could both be restricted and delayed. The New Dawn has given us the light. We must now find the way for moving faster and covering wider areas. The challenges before the Third World which impose this imperative need no recounting.

TWAS President Abdus Salam and TWAS Vice-President M.K.G. Menon at the First Meeting of the newly established Third World Network of Scientific Organizations (TWNSO).

There is tremendous resource base for Science and Technology in the Third World. It is all there. We may not be exactly in the days of Professor Salam's Michael the Scot; but we have enough to be able to substantially solve our problems through achievements totally based in the Third World, of the South, and through access to resources in the North, in the form of South-North linkages.

Our resources can be categorized according to the way Higher Education, Science and Technology are organized, controlled and disseminated. These include Universities and Institutes of Research and the way these are organized and owned in the various countries; the National, Regional and International Scientific Organizations; the National Academies of Science; and the Third World Scientists working individually both in the South and in the North, the latter being justifiably regarded as being the diasporic Third World Scientists.

In the Socialist countries, the Academies of Science are effectively, at once, the Science Ministries of Government in that they control their Institutes of Research. In most other places, the Ministries of Higher Education, Science and Technology are in charge. That is why we considered it important to invite the Honourable Ministers concerned to join in this Network. With the great control that all Governments, especially Third World Governments, exercise over personnel, resources and events in their respective domains, the cooperation of governments is as crucial as are political sympathy and clout enjoyed by individual scientists and scientific centres or organizations. In any event, the key figures in all these categories have crucial roles to play in promoting the objectives of the Third World Academy of Sciences.

We hope that we now have a fair idea as to why we are here. We should, therefore, proceed to address ourselves to some vital issues at hand and accomplish some of the objectives in order to catch up with ourselves, as it were. There is a circulated draft programme for the meeting within the context of which the structure and functions of the Network, its thrust and targets for the next few years, and, even its name, will be open to discussion. As to the name, may I suggest that the name "Network" seems to be as good as any and has the added advantage of being emotively neutral. It simply connotates person-to-person and people-to-people cooperation and friendship. I also think that, for similar reasons, whatever else we agree upon, the organization should remain an NGO (non-governmental organization) in which governments of the South will participate and which governments of both North and South will actively support. It is our hope that some high officials of the organization will be identified and mandated for a period of, at least, one year, to carry on with the programmes to be broadly formulated here. The organization will, in addition to its Headquarters, need Regional Centres located in venues, one in each of the three main zones of the Third World, namely Africa, Asia and Latin America. The location, mode of operation and maintenance of these Centres and the Headquarters should be settled. Finally, it is our sincere hope that we shall all endorse the statement of commitment to the goals and objectives of the Network, as circulated

Ladies and Gentlemen, I welcome you, once again, and thank you for your attention.

Trieste Declaration

Science and Technology as an Instrument of Development in the South

Recognising the fundamental importance of Science in socio-economic and cultural development and technological progress, and keeping in view the recommendations of the South Commission pertaining to the crucial role of Science in the Third World, as mankind approaches the 21st century, the members of the Third World Network of Scientific Organisations present at the meeting held in Trieste from 4-6 October 1988, resolve to work towards giving Science and Technology a position of highest priority in their own countries and to strengthen their collaboration with other countries of the South as well as of the North.

TWAS 1987 Awards Presented

At an impressive ceremony coinciding with the inaugural session of the Women's Conference, Senator Susanna Agnelli (Italy) presented the TWAS 1987 Awards to five deserving recipients: Prof. Cesar Mansueto Giulio Lattes (Physics), Prof. Chen Chuang-tian (Chemistry), Dr. Adolfo Martinez-Palomo (Biology), Prof. Mudambai Seshachalu Narasimhan (Mathematics), and Prof. David A. King (History of Science).

Each award winner gave a brief talk highlighting his research findings to the delight of the distinguished assemblage of Nobel Laureates, eminent scientists and researchers. Prof. King's lecture was particularly very well received.

The Awards Scheme has been instituted by the Academy to accord recognition to outstanding accomplishments of Third World scientists. The essay competition leading to the History of Science Prize is open to authors from the South as well as the North.

TWAS 1987 Physics Award

Prof. César Mansueto Giulio Lattes (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil) for *his fundamental contributions to High Energy Physics and in particular for the discovery of natural and artificial mesons.*

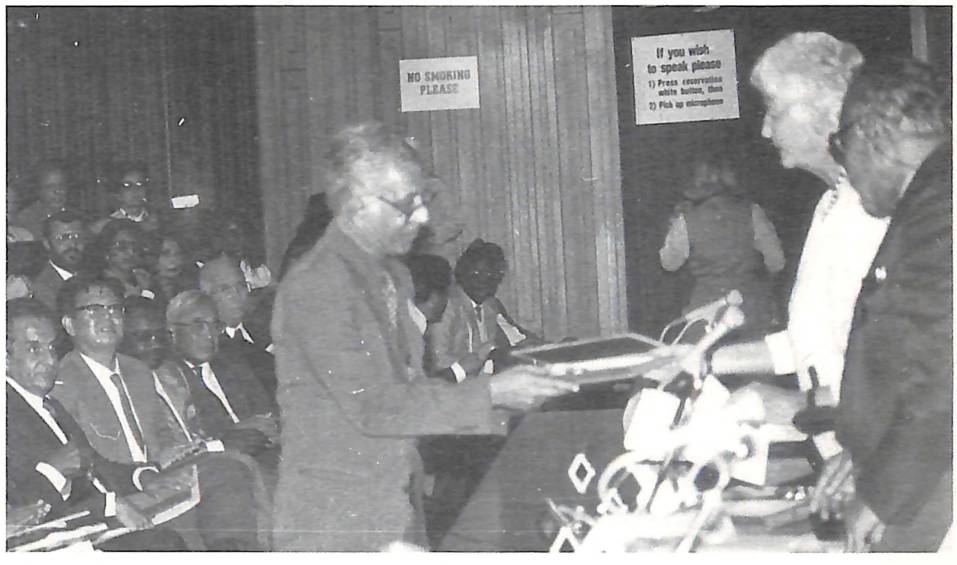
Prof. César Mansueto Giulio Lattes, the second son of Italian emigrants, Giuseppe Lattes and Carolina Maroni Lattes, obtained his Bachelor's degree in Physics from the Universidade de Sao Paulo in 1943. In a distinguished career spanning almost 45 years, the academic positions held by Lattes have included:

Assistant Professor of Theoretical and Mathematical Physics, USP 1944-1948; Professor of Physics, USP 1948-1949; Professor of Nuclear Physics, Universidade do Brazil (now Universidade do Rio de Janeiro) 1949 to date; Professor of Physics, Centro Brasileiro de Pesquisas Fisicas, 1949 to date; Professor of Fisica Superior, USP 1960-1986 (partial retirement) November 1986; Professor of Physics, Universidade Estadual de Campinas, 1967-1986 (partial retirement November 1986); and Professor of Physics, Pontificia Universidade Catolica do Rio de Janeiro, 1964.

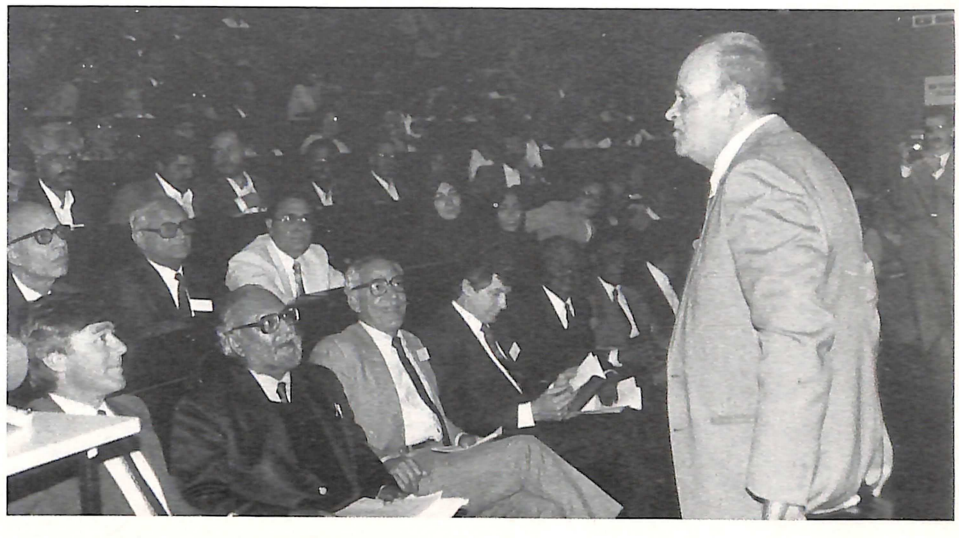
In the capacity of a researcher, he has served as:

Research Associate, Bristol University 1946-1947; expert consultant, Radiation Laboratory, University of California, Berkeley, under contract with USNA Atomic Energy Comission 1948-1949; Associate Professor, University of Chicago, 1955-1956; Research Associate, University of Minnesota, School of Science and Engineering, 1957; and visiting scholar, Intituto de Geologia Nucleare, CNEN, Pisa Italy, 1964.

His theoretical scientific work has mainly related to statistical thermodynamics at high temperature plus high



Above: Senator Susanna Agnelli presents the 1987 TWAS Awards. Below: Physics Award Recipient C.M.G. Lattes (Brazil).



density and the abundance of nuclei in the universe (in association with G.V. Wataghin), and classical theory charged point particles with dipole moment (under Frenkel condition) with W.C. Schutzer and M. Shonberg as collaborators.

His non-theoretical scientific work has been fairly exhaustive and included many important research undertakings such as:

Calibration of concentrated Ilford Research Emulsion produced by Mr. C. Waller 1964); A study of Alfa-radioactivity of rare earths, unsuccessful search for element 61 (1946 Bristol); A nuclear emulsion method for determination of energy and momentum of fast neutrons in cosmic rays, with G. Occhialini (1946 Bristol); Detection of negative pions produced by 380 MEV Alfa-particles on fixed target, with Eugene Garder (1948 Berkeley); Detection of positive and negative poins photoproduced by Bremsstrahlung of 300MEV electrons accelerated in the radiation laboratory electron sincrotron: for Edwin McMillan (January 1949 Berkeley); Unsuccessful search for the electronic decay of the positive pion, with L. Anderson (1956 Chicago), and the study of the angular correlation in the decay of PI+ into MU+, with P.S. Freier (1957 Minneapolis).

Prof. Lattes was the ad-hoc coordinator of the Brazilian part of the Brazil-Japan collaboration on study of cosmic rays and high energy interactions: morphology and study of multiple production of hadrons. Started in Sao Paulo University 1962 and joined by CBPF 1964, by UFF around 1983, and FUFMT in 1988, also joined by Soviet and Polish groups of Pamir collaboration in 1981.

The 1987 Award for Chemistry went to Chen Chuang-tian (centre) from China.

TWAS 1987 Chemistry Award

Prof. Chen Chuang-tian(Fujian Institute of Research on the Structure of Matter, Fuzhou, Fujian, China) for*his outstanding contribution to the development of new nonlinear optical materials, the formulation of a quantum chemical theory that guides the search for such materials and the discovery of beta barium borate and lithium triborate.*

Prof. Chen Chuang-tian was born in Ningbo, Zhejiang, China on April 1, 1937. He obtained a B.S. degree in Theoretical Solid-State Physics from Beijing University, Beijing, in 1962. He was hired as a research assistant at the East China (later changed to Fujian) Institute of Research on the Structure of Matter, an institute of the Chinese Academy of Sciences in Fuzhou, Fujian, founded and directed by Prof. Jiaxi Lu. He rose to the rank of full professor in 1986 and became Deputy Director in charge of research in 1988. He did research at Stanford University during the academic year 1985-86 and has been a frequent visitor to major U.S. and European research institutes since then. His work in new non-linear optical materials and contributions to the national economy have been recognized and appreciated by both the provincial and national governments. He was named and received by the Premier of China on March 12, 1987, as one of nine outstanding contributors in the nation.

He was initially reluctant about his assignment to Fujian Institute of Research, which was then famous in China for its structural chemistry research but not known for its physics and materials science research. Sev-

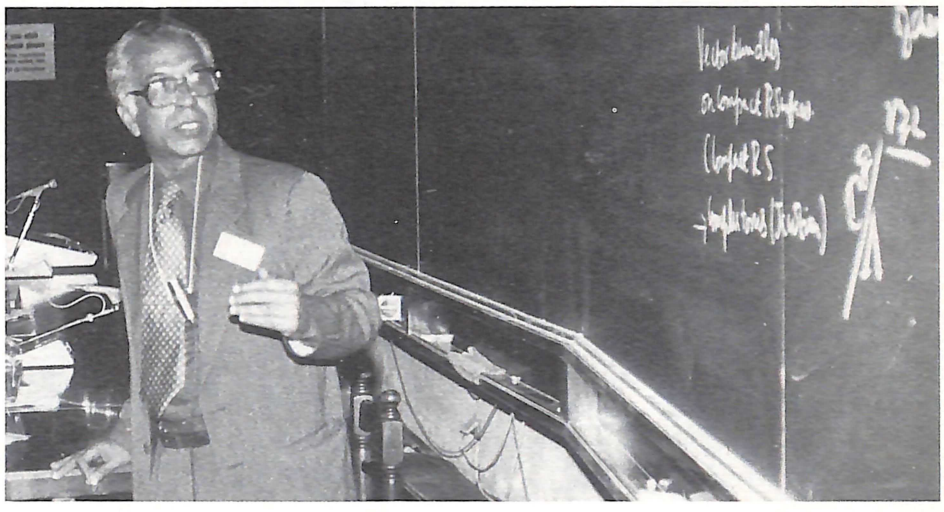
Adolfo Martinez-Palomo (Mexico) received the1987 Biology Award.

eral of his professors convinced him he could study electrooptic and nonlinear optic properties at this institute as high quality, large crystals of $NH_4H_2PO_4$, KH_2PO_4 (KDP), and KD_2PO_4 were produced there for scientific and technological applications in China. Indeed, he studied proton NMR spectra of KDP crystals and, with some helpful suggestions from Prof. Lu, succeeded in explaining the paradoxical spectral behaviour in terms of the proton location in the hydrogen bonds. He then started a structural chemical investigation into the origin and mechanism of nonlinear optical properties of inorganic oxides. Unfortunately, this study was soon interrupted by the Cultural Revolution of 1965-1973. During that period, he grew single crystals from melts and measured their optical and dielectric properties.

He resumed his theoretical study of structure-property relationships in nonlinear optical materials after the Cultural Revolution. Very soon he formulated the anion group theory, a quantum chemical theory that describes and predicts the nonlinear optical behaviour of inorganic solids based on the functional, oxygen-containing anion group. Consider for example, $BaTiO_3$, a well known and well characterized material. The anion group theory ascribes the second harmonic effect into microscopic and macroscopic parts. The microscopic part arises from each deformed TiO_6 octahedron, which can be computed quantum-chemically by perturbation theory practically without any adjustable parameters. The macroscopic effect is then a linear superposition of the microscopic second harmonic tensors. This way, the second harmonic coefficients of $BaTiO_3$ were computed and agreed satisfactorily with experimental data. Similar agreements have also been obtained for other perovskites and tungsten bronzes. This initial success immediately attracted the attention of Prof. Lu, who has since provided constant encouragement, support and advice to the search for new materials.

Buoyed by this success and in collaboration with several colleagues from the Fujian Institute of Research, Prof. Chen expanded the scope of his investigation to iodates and nitrites. The lone-pair electron of the IO_3-anion enhances the second harmonic generation. The NO_2-group is the first example of a planar functional unit and its nonlinearity is enhanced by the conjugated π orbitals perpendicular to the NO_2^- units. Based on these results on lone-pair electron and π orbitals, a set of structural criteria was derived as guidelines for the search for and development of new crystals.

Subsequently, the borate series was discovered including both lithium triborate (LiB_3O_5) and a low temperature form of barium borate (BaB_2O_4). The successful developments of these crystals are the culmination of unwavering support and collaboration of colleagues from the Fujian Institute of Research and contributions from other research institutes of the Chinese Academy of Sciences and worldwide. Both borates are transparent deep into the UV region: BaB_2O_4 (BBO) is transparent to 189 nm and LiB_3O_5 (LBO) to 180 nm. Both have high optical damage thresholds and are usually homogeneous and practically non-deliquescent. BBO and LBO are complementary: BBO is currently



M.S. Narasimhan (India) received the TWAS 1987 Award for Mathematics.

The first TWAS Prize for the History of Science was awarded to David King (United Kingdom)

the only crystal that can generate the 5th harmonics (212 nm) of the 1.06μm output of a YAG:Nd laser whereas LBO has very large acceptance angle and can be non-critically phase-matched. Hence these two crystals are already internationally acclaimed and with good prospects of broad applications in laser science and technology. Development of other UV transparent, nonlinear optical crystals of the borate series is continuing.

TWAS 1987 Biology Award

Dr. Adolfo Martinez-Palomo (Centro de Investigacion y de Estudios Avanzados del IPN, Mexico D.F. Mexico) for *his fundamental contributions to the knowledge of the cell biology of cancer cells and parasites.*

Dr. Adolfo Martinez-Palomo was trained as a physician in Mexico. He carried out his postgraduate studies in Canada, where he found the first experimental suggestion that the heart is not only an efficient pump, but also an endocrine organ. He then moved to France where he made observations now considered classical on the abnormalities of the surface of cancer cells, with the use of the electron microscope. Back in Mexico he initiated, with the tools of modern cell bioloby, a far-reaching study on one of the most important parasitic diseases of man, amebiasis. His first contribution in this field was the demonstration of biological differences between pathogenic and non pathogenic amebas, a discovery of importance for understanding the epidemiology of the infection. Afterwards, he turned his attention to elucidate the cellular bases of the destructive effect of the parasite on mammalian tissues, using *in vitro* and *in vivo* models. The investigation gradually broadened in scope to include aspects of the pathology, immunology and control of the infection, summarized in two books that represent the first modern and comprehensive monographs on amebiasis. He has attracted several eminent investigators and obtained support to create the Mexican Programme for the Study of Parasite Diseases, which represents one of the best examples that first rate research on diseases of the poor can be done in the Third World. His individual achievements are best framed within the accomplishment of this group, in constant search for academic excellence through active international scientific cooperation.

As President of the Mexican Academy of Sciences he renewed the collaboration between the National Academy of Sciences and its Mexican counterpart. He is an active member of the council of the Latin American Academy of Sciences and of the International Commission on Health Research, an independent initiative based at Harvard University that seeks new solutions to the pressing health needs of developing countries. His more recent responsibility is the formulation of the programme on science and technology for health for the next administration of the Mexican government.

His current academic interests include the biology of amebiasis and giardiasis, the structure and function of epithelial membranes, and new developments in immunoelectronmicroscopy.

TWAS 1987 Mathematics Award

Prof. Mudumbai Seshachalu Narasimhan (Tata Institute of Fundamental Research, Bombay, India) for *his fundamental contributions to mathematics in the areas of algebraic geometry, differential geometry, representation theory of semi-simple groups and partial differential equations.*

Born on June 7 1932. Joined the Tata Institute of Fundamental Research (TIFR) in 1953 as a research student and did his thesis in anlysis under the supervision of Professor K. Chandrasekharan. His post-doctoral work was carried out in Paris for a two year period with Professor Laurent Schwartz. At present he is a senior Professor of Mathematics at the Tata Institute of Fundamental Research.

His contributions to mathematics are in the fields of algebraic geometry, differential topology, representation theory of lie groups and partial differential equations.

In algebraic geometry the major contribution (over the past 20 years) has been the development of the theory of moduli of algebraic vector bundles, starting with the basic theorem on the identity of stable and unitary bundles on algebraic curves.

Results in differential geometry include the theorem on the existence of universal connections which have been extensively used by mathematicians and physicists.

The langlands conjecture on the concrete realization of the discrete series representations was solved in the hermitian symmetric case for most weights. A characterisation of real analytic functions via an elliptic differential operator with analytic coefficients was given. This contains as a special case well known analytic regularity theorems.

TWAS First History of Science Prize

The Academy set up an award of US$10,000 for the best research essay highlighting the pre-20th century scientific achievements of a Third World scientist, whose work had not previously been recognized. The essay was to indicate the impact of the scientist's contributions on his/her community, and to establish its influence on modern scientific thought. The essays submitted for this competition, open to scholars from the South as well as the North, were carefully judged by an International Committee of experts on the History of Science appointed by the Council of the Academy.

The Prize was awarded to Prof. David A. King (Johann Wolfgang Goethe University, Frankfurt/Main, Fed. Rep. Germany) for *his essay entitled "Shams Al-Din Al-Khalili and the Culmination of the Islamic Science of Astronomical Timekeeping", and in particular for bringing to light the higly impressive astronomical tables compiled in Damascus in the 14th century and used there until the 19th century for timekeeping.*

David A. King is Professor of the History of Science and Director of the Institute for the History of Science at Frankfurt University, a position which he has held since 1985.

Born in England (1941), he studied

mathematics at Cambridge University and education at Oxford University (1960-64); his first appointment was with the Sudan Government Ministry of Education (1964-67). Thereafter he did his graduate work in Islamic Studies and the History of Science at Yale University (1968-72), specializing in the history of Islamic science. Since then he has directed the Smithsonian Institution Project in Mediaeval Islamic Astronomy at the American Research Centre in Egypt (1972-79) and been Associate and Full Professor of Near Eastern Languages and Literatures at New York University (1979-85).

Professor King has worked extensively on mediaeval scientific manuscripts in libraries all over Europe, the Near East, India and Central Asia, and has recently published a three-volume catalogue of over 2,500 Arabic, Persian and Turkish scientific manuscripts preserved in the Egyptian National Library in Cairo. His early research focussed on technical achievements of the Muslim astronomers (hence his interest in al-Khalili), but he has also worked extensively on popular folk astronomy, and particularly on the interplay of science and religion on mediaeval Islamic society.

His publications include some sixty articles, many reprinted in two volumes entitled *Islamic Mathematical Astronomy and Islamic Astronomical Instruments* (London 1986-87). These contain, for example, the first history of astronomy in Egypt and Syria, and descriptions of various astronomical tables for finding the direction of Mecca *(qibla),* regulating the times of prayer, and predicting the visibility of the lunar crescent. Also in book form are a history of astronomy in the Yemen (1983) and a history of astronomical timekeeping in the Islamic world (to appear); he also co-edited a volume of studies in honour of his former teacher, Professor E.S. Kennedy of the American University of Beirut (New York, 1986). He is currently preparing a book on the sacred direction in Islam and a history of astronomy in the Maghrib.

His acceptance speech delivered on 3 October 1988 follows.

Dr. King Recounts His Research on Al-Khalili

It is of course a great honour for me to be present on this occasion as the recipient of the first TWAS History of Science Prize. I sincerely appreciate the recognition which this implies, but I want to thank the Academy for instituting this prize. I think that we owe this to the foresight of Professor Salam for recognizing the importance of the history of science in the Islamic World, India, China and Latin America.

I cannot accept this prize for myself, but I gratefully accept it in trust. The funds will be used for the furtherance of the history of Science in the Islamic World; they will be used to produce more such works as the book on al-Khalili which the Academy will be publishing.

Now I should like to say a few words about my work in general and my research on al-Khalili in particular. My field of specialization is the history of science, particularly the exact sciences, astronomy and mathematics, in the Islamic world. The time-frame is from the eighth century to the nineteenth, and the geographical area extends from the Maghrib to Central Asia. I am also interested in the popular folk science which had its origins in Arabia before Islam and has been practised up to the present day all over the Islamic Commonwealth from West Africa to China and Indonesia. The unity is provided in both cases by the religion of Islam (although a minority of the scientists I am interested in were Christians or Jews). Colleagues of mine are working on the history of the exact sciences in India and China. The subject is of course a part of a larger picture, the history of the exact sciences in the Ancient Near East, India and the Hellenistic world, and the development of modern astronomy out of the mediaeval and Renaissance traditions in Europe.

The branches of ancient and mediaeval mathematical astronomy are manifold: they include arithmetic and trigonometry; different calendars and conversion of dates from one to the other; mathematical geography (latitudes and longitudes); solar, lunar and planetary astronomy (determination of mean and true ecliptic longitudes, latitudes, and stations); stellar astronomy and celestial coordinates in general; spherical astronomy (the study of the apparent daily rotation of the heavens) and timekeeping by the sun and stars; visibility of the moon and planets; prediction of eclipses; theory and use of instruments; and — last but certainly not least — mathematical astrology. I already mentioned folk astronomy: this is a label for the astronomy of the Arab navigators of the Indian Ocean, as well as — on land — popular, non-mathematical techniques for regulating calendars, traditional star-lore and meteorology, simple timekeeping by day and night for ritual purposes or for controlling the flow of water for irrigation purposes. Its study is important not least because some of these practices or traces of them survive to this day in, for example, the agricultural calendar of Indonesian farmers, and the migration patterns of herdsmen in Afghanistan, the Sudan, and Mauritania.

The foundations of the field as I found it when I started working on Islamic science as a graduate student in 1970 had been established by a series of scholars mainly over the past 150 years. It was the Arabic scientific manuscripts preserved in European libraries which attracted the attention of Orientalists such as the Sédillots in Paris in the early nineteenth century. It was also in Europe that the major collections of Islamic scientific instruments were preserved; these too attracted the attention of historians. The Italian Nallino (it is always a pleasure to talk about Nallino when I am in Italy), the Swiss Suter, and various German scholars (such as Wiedemann, Luckey, and Schoy) continued in the tradition started by the Sédillots.

In 1900 Suter made a list of over

500 Muslim astronomers and mathematicians and their works. He based this list mainly on the published catalogues of the holdings of European libraries, and was fully aware that there were rich collections all over the Near East that were out of his reach. For the first time we had a picture of the breadth of Muslim interest in astronomy and, in many cases, biographical information to enable us to see the astronomers as individuals and to view them in historical and cultural context.

Suter also published the only surviving (Latin) version of the astronomical tables of al-Khwarizmi. About the same time Nallino published the astronomical tables of al-Battani. Both of these sets of tables were important because they had widespread influence in Europe; their influence in the Islamic World was not so great because there they were replaced with more up-to-date tables.) But these are still the only two sets of Islamic astronomical tables which have been published in the optimum form: text, translation and commentary. In the fifties the American scholar E.S. Kennedy identified 125 different astronomical handbooks with tables compiled between 750 and 1750. Also it was Kennedy who first applied the computer to the study of Islamic astronomical tables, particularly useful in the case of tables whose structure was not self-evident.

Over the decades our control over the contents of individual libraries, particularly those in the lands of the Near East, India and Central Asia, has improved considerably as a result of cataloguing and bibliographical projects. During the past two decades the Turkish scholar F. Sezgin has documented all the available (textual) sources for the history of astronomy, folk astronomy, and mathematics up to the eleventh century, relying not only on European manuscript collections but also on the holdings in libraries from the United States to India.

Unfortunately the history of Islamic science is still a specialist field, most of what is written on the subject appearing in scholarly journals and publication series. There is not a single book in any language on Islamic science in general or Islamic astronomy in particular which I could recommend to you for an overview of the subject. There is therefore a desperate need for a reliable popular survey, and I am happy to say that an encyclopaedia of Islamic science in three versions, English and French and Arabic, with contributions by the leading experts in each area is currently being published in Paris.

Where does my own research fit into this general picture? When I started in this field in 1970 I had been for three years a teacher of high-school mathematics in the Sudan. I cannot claim to be a scientist or a historian. At that time I had only a background in mathematics, and I knew enough Arabic to read a newspaper. I acquired the necessary academic skills by sitting at the feet of teachers in the US who taught me how to read classical Arabic, how to read mediaeval scientific texts and understand what I was reading, and how to analyze mediaeval astronomical tables and to understand their purpose.

My first academic appointment was in Cairo, where I had access to the 2500 astronomical manuscripts preserved there. Some 500 of these were in the Library at the end of the 19th century and these were then dutifully catalogued. But there were 2000 which had been acquired during this century and which no-one had ever looked at. I was able to catalogue the entire collection, and with research grants I was also privileged to visit manuscript libraries in India, Soviet Central Asia, the Near East, and Europe.

Needles to say, while looking through so many previously unstudied manuscripts I came across all sorts of interesting material. Already as a graduate student I had been alerted to a category of Islamic astronomical tables which Kennedy had not found during his survey of Islamic astronomical handbooks. For my dissertation I had ordered a microfilm of what I thought was one of these handbooks, but it turned out to be something quite different: a corpus of two hundred pages of tables for timekeeping and regulating the astronomically-defined times of the five daily prayers, all specifically computed for Cairo. Since the times of prayer are astronomically defined, they vary from day to day and from one locality to another; so to regulate them properly, it is useful to have tables. But such tables were not known to have been prepared by Muslim scholars. During those years in Cairo I found over 500 manuscripts in different libraries around the world containing tables for timekeeping for different localities all over the Muslim world from Morocco to China. The material formed the basis of a series of publications and a book on the history of astronomical timekeeping in Islam, shortly to go to press.

There was also new material on the determination of the direction of Mecca, called *qibla*, which Muslims face in prayer. The adoption of a sacred direction towards Mecca is one of the most distinctive aspects of Islamic ritual, yet there was no history of Muslim attempts to determine the *qibla*. There were texts on approximate and exact procedures to find the *qibla* mathematically. All Islamic religious architecture is oriented in the *qibla*, and I even found texts which explain why some mediaeval mosques do not face Mecca in the way we might expect them to.

There was also new material on the regulation of the Islamic calendar by the prediction and observation of the appearance of the lunar crescent at the beginning of the month. Muslim astronomers from the eighth century onwards were able to predict whether or not visibility would occur, and the debate as to whether one should take their predictions seriously has lasted right down to the present day. There is enough material available to document this important aspect of Islamic science, but this is still a task for the future.

I found this material exciting not only because it had never been studied but also because of its distinctively Islamic flavour: this was "science in the service of Islam". It was not important for the development of modern "West-

ern" astronomy: very little of this material had been transmitted to the West, but its study could add a new dimension to the history of Islamic science, and that is what I have tried to achieve. In addition, of course, there was new material of a technical nature — theories, tables, instruments — all of which I have tried, or am trying, to write up in one form or another.

So my contributions have been like adding a few pieces to an enormous jig-saw puzzle. If I deserve any praise it is only for finding a few pieces of the puzzle on the floor and putting them back on the table for myself and others to try to add to the puzzle.

Now that you have seen the general outline of my research, I should like to say a few words about my friend al-Khalili. One of the pieces of the jigsaw puzzle had his picture on it, or to be more precise, his name. Let me share with you some illustrations of al-Khalili's environment and his works. Al-Khalili worked in the magnificent Omayyad Mosque in Damascus in the middle of the fourteenth century. He was one of a team of astronomers associated with the Mosque whose main duty it was to regulate the times of the prayers. His colleagues produced significant writings on solar, lunar and planetary theory; indeed in the fifties it was discovered that the models shown here were mathematically the same as those used by Copernicus in Poland 150 years later. They also produced instruments such as this magnificent sundial 2 metres wide.

There is a manuscript attributed to al-Khalili in the Bibliothèque Nationale in Paris (this is the title folio); it was catalogued already a hundred years ago. Suter mentioned al-Khalili and the Paris manuscript in his survey of Muslim scientists and their works. From the catalogue it was clear that the manuscript contained tables having to do with timekeeping. Once my interest in that subject was roused in 1970 I ordered a microfilm of the Paris manuscript. When I saw the contents I really could not believe my eyes. There were 200 pages of tables of the same kind as I had found already for Cairo, but some were for Damascus, and there were other, more interesting tables too. We now know of over 300 manuscripts of al-Khalili's tables in libraries all over the world, but the Paris copy is the earliest and most complete — in short, the best — and this is the one the Academy will soon publish in facsimile form.

The first group of tables was for regulating the times of the five daily prayers. In Islam the times of prayer are astronomically defined. The Islamic day begins at sunset with a prayer. The second prayer begins at night fall and the third at daybreak. The fourth begins shortly after midday and the fifth near the middle of the afternoon. I will not go into the details of the precise definitions which have been in use since the eighth century and are still used to this day. The first group of al-Khalili's tables display for each degree of solar longitude, roughly corresponding to each day of the year, such quantities as the duration of day and night, the duration of morning and evening twilight, the time of midday, and the time of the afternoon prayer. There are about 2000 entries in the whole set. The numbers in the tables are expressed in an alphabetical-numerical system in which a = 1, b = 2 and so on, as was standard in Greek and Islamic astronomy. Each of al-Khalili's tables has been recomputed with a computer according to the appropriate trigonometric formula and we can show, for example, that when he computes values to degrees and minutes, the minutes are generally correct or in error by ±1 or ±2, a remarkable achievement for computation by hand.

The determination of the times of prayer is only one aspect of Islamic timekeeping. For an astronomer before the age of clocks the sun and stars provided the best way to find the time. By measuring the altitude of the sun above the horizon, and then by applying a fairly complicated formula, it was possible to find the time from the altitude, the local latitude and the day of the year. The second group of al-Khalili's tables display the time of day for Damascus as a function of the solar altitude at any time of the year. These contain some 3000 entries. You find the altitude of the sun with an instrument (such as an astrolabe or quadrant) and then feed the solar altitude into the table which gives you the time of day far more accurately than you could get from any instrument. All of the calculation has been done for you. But the tables only work for Damascus.

Al-Khalili's greatest mathematical achievement was the compilation of a third set of tables which he claimed could be used for solving problems of spherical astronomy and timekeeping for any terrestrial latitude. These tables which contain 14,000 entries displayed trigonometric functions of no immediate significance, but which were so devised that ordered applications of them would indeed lead to the solution of any problem of the above-mentioned kind for any latitude. I call these the universal auxiliary tables, and for their application I refer you to my book.

The most remarkable computational achievement of al-Khalili was a fourth set of tables displaying the direction of Mecca as a function of the terrestrial latitude and longitude. The basic problem of finding the *qibla* is one of mathematical geography, and the formula for the *qibla* is one of the most complicated that was known to mediaeval scientists. Nevertheless al-Khalili managed to compute the *qibla* for each degree of latitude and each degree of longitude difference from Mecca for the whole Islamic world and beyond. In general his 3000 *qibla* values are accurately computed or correct to within a few minutes, again a remarkable achievement.

From an investigation of all the available manuscripts it is clear that al-Khalili's main tables for timekeeping were used in Damascus from the fourteenth to the nineteenth century. His universal auxiliary tables represent the culmination of the Muslim achievement in numerical solution of problems of astronomical timekeeping. His universal *qibla* table is the final solution to the *qibla* problem. In the book I have shown how some of al-Khalili's tables were modified and adjusted, and how some were borrowed by later astronomers in Cairo, Tunis, and Istanbul. They were not at all known in

Europe until modern times. But that is hardly important. What is important is that they were compiled in Syria by a Syrian astronomer, and they are only one example (albeit an impressive one) of such productions from Maghrib to China and from Turkey to the Yemen.

Our Institute in Frankfurt has an open-door policy towards students who have the right attitude and who are prepared to study the necessary technical aspects and languages. We also welcome visiting scholars who use our library and facilities. We are currently involved in collaborative research with colleagues in Spain, Holland, the US and the USSR, but also — and I stress this — with colleagues in Algeria, Iran and India. I myself have already written surveys of the history of astronomy in Egypt, Syria and the Yemen and I am currently working on the history of astronomy in the Maghrib.

I am currently trying to get a young Yugoslav astronomer to Frankfurt to write the first history of astronomy in Yugoslavia as a doctoral dissertation — he has already written surveys of the prehistoric megalithic sites there, and he has collected data on the astronomical activities there under the Ottoman Turks. Yugoslavia is not the Third World but I use it only as an example; there is also Morocco, Algeria, Libya, Tunis, Egypt, Syria, Turkey, Saudi Arabia and the Gulf States, the Yemen, Iraq, Iran, Afghanistan and Central Asia, not to mention Pakistan and Muslim India, Indonesia and Muslim China. Yes, we even have a medieval astronomical handbook in Arabic compiled about 1400 in Tibet. For folk astronomy every single region qualifies, which is why I said at the beginning that I was interested in a region extending as far as Indonesia, China and Zanzibar. There is plenty of research to be done, and no shortage of worthwhile topics.

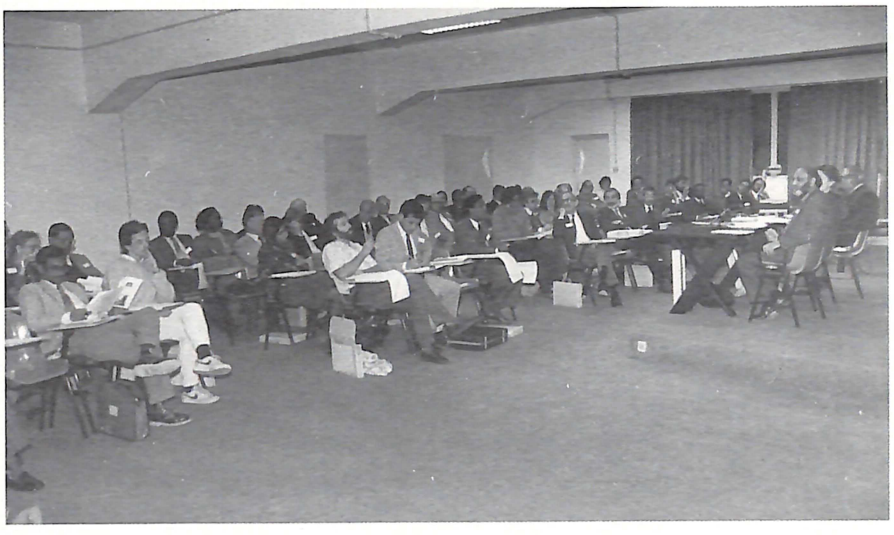
I am sure that we shall be collaborating with the Academy in the future, our joint goal being simply a better understanding of the history of a scientific tradition in a vast area of the world which has been somewhat neglected and underappreciated in the past, but which is full of promise for the future.

An extract from the qibla - table of al-Khalili. For each degree of latitude, entered horizontally, and each degree of longitude, entered vertically, the table displays the qibla, measured from the meridian and expressed in degrees and minutes. Most of the entries are accurate or in error by ±1 or ±2 minutes. The tables on this particular pair of pages serve latitudes 28°, 29°, ..., 33°, and the entries for each latitude are arranged in two columns, as are, appropriately, the longitude arguments. Each entry corresponds to two longitude arguments at an equal elongation from the meridian of Mecca, whose longitude is taken as 67° (measured from the Canary Islands, as was standard in mediaeval geography).

Network Proposed for Increasing the Flow of Scientific Literature to the Third World

The formation of a Network on Scientific and Technological Literature for Developing Countries (ST-LITNET) has been proposed to enhance the flow of scientific literature to Third World institutions.

The proposal was mooted at the Workshop on Increasing the Flow of Scientific Literature to Third World Institutions, jointly sponsored by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Centre for Science and Technology for Development (UNCSTD), the International Council of Scientific Unions (ICSU), the International Centre for Theoretical Physics (ICTP) and the Third World Academy of Sciences (TWAS) in Trieste, from 31 October to 2 November 1988.



The Workshop in session

The participants represented a wide spectrum of international agencies, learned societies, and publishing houses engaged in the dissemination of scientific information. An overwhelming mojority, if not the entire assemblage of participants, appeared conscious of the multifarious problems experienced by developing country researchers in keeping abreast of the latest information and felt the urgency of boosting the flow of literature, both current and archival, to the Third World. The consensus: with greater coordination, a speedy and better-knit distribution programme could emerge in the form of "ST-LITNET". The formation of the Network was thus seen as a timely and attractive proposition.

The Workshop was attended by representatives of UNESCO, the International Atomic Energy Agency (IAEA), the United Nations Centre for Science and Technology for Development, the US National Science Foundation, the American Association for the Advancement of Sciences, the US National Academy of Sciences, the International Foundation for Science, the Canadian Organization for the Development of Higher Education, the Swedish Agency for Research Cooperation with Developing Countries, the American Mathematical Society, the Physical Society of Japan, the Asian Institute of Technology, the Latin American Academy of Sciences, the African Academy of Sciences, the International Union of Pure and Applied Physics, the International Union of Biochemists, the International Programme in the Physical Sciences, the McGraw Hill Book Co. (UK) Ltd., the World Scientific Publishing Co. Pte. Ltd., Elsevier Science Publishers, the British Library Document Supply Centre, and many more important organizations.

The participants agreed that funds needed to create and maintain ST-LITNET would be sought from external sources so that the limited finances currently available for the distribution of scientific literature to developing countries would not be curtailed or reduced in any way.

The *immediate objectives* of the Network were defined as follows:

(1) To coordinate information on (a) organizations active in donation programmes; (b) the institutions they serve, and (c) the materials, especially journals, they provide, in order to avoid duplication of efforts and to increase the impact of limited resources; (2) To offer information on appropriate programmes and individuals wishing to provide books, journals, or related material; (3) To explore additional sources of literature; (4) To advise on sources of the funding needed to expand the scope of existing distribution programmes and to launch new ones; (5) To identify additional needs and opportunities.

Long-term objectives include: (1) Supporting scientific publishing in the South; (2) Increasing the distribution of scientific materials produced in the South to other regions.

The Network's activities will be coordinated by the ICTP/TWAS and its membership will be open to all international organizations.

Opening remarks

In his opening remarks, Professor Abdus Salam, Director of ICTP and President of TWAS, observed:

"The objectives of our meeting are simply stated. We wish to provide the Third World with scientific literature. One of the reasons why I left Pakistan in 1954 and made myself an exile was that no library in the country had ever

received any journals after World War II. Without literature, you cannot do any research. The situation by and large is still the same. Every time there is a financial cut, the first casualty is foreign publications in almost all developing countries.

"There are some formal principles which I personally believe in. I do not believe in anything else except the printed page in the old-fashioned way. If the *Torah* had been revealed not on tablets but on microfiche, with some electronic device needed to read it, it would not have carried the same impact.

"Regarding the provision of the printed word, there are many ways of doing this. We know the problem. There could be more than one solution which are all equally acceptable (this, incidentally, is the difference between Science and Technology. Usually there is a unique answer in Science to a proposition, whereas in Technology there are hundreds of answers — for example, the design of a door of an automobile can differ considerably from one make to another). We must listen carefully to all the proposals.

"There is the solution proposed by UNESCO, which consists of setting up a fund which pays royalties for access to the loan and photocopy services of major international suppliers. Some 500 periodicals are identified as being most needed. 'Subscriptions would be placed by local institutions but funds would be administered by UNESCO, which estimated that for a seven year programme they needed one million dollars per country. The development agencies and the other funding sources which have been approached have not reacted positively to this proposal.'

"The simplest proposal in my opinion would be the one which the Chinese have adopted. All scientific journals and all scientific books are reprinted at Hefei University in China and sold for a fraction of the price — usually one third of a dollar. They can do this because they do not adhere to the copyright law. They would not supply anyone else outside China for the same reason. So far as journals are concerned, they are supplying journals to a set of people who would not be able to afford the price of these.

"Let us discuss the copyright law in the case of journals. The author makes no money by publishing his/her work in journals. He/she or his/her institution, as a general rule, usually pays for publication privileges to one of the professional societies. I do not know the system of pricing in their case. The journal can then be sold rather cheaply. The commercial publishers, on the other hand, as a rule, make no charges. However, their prices are prohibitively high (the situation for books is, of course, different, because here the author also comes into the picture without his royalties which are of the order of 10-15% of the selling price of the book).

"The Third World Academy of Sciences has identified 43 countries of the world which would benefit from the scientific journals and the books being provided to them. For the journals alone, provision of one of the journals on basic sciences — mathematics, physics, chemistry and biology — would cost approximately US$100,000. For the 43 countries, if only one copy was being supplied, the totals would be around US$4.5 million. If one was going in for applied sciences and technology, and science-based technology, this would come to a higher figure — perhaps of the order of US$15-20 million. Can one hope that some Fairy Godmother, like the World Bank, would help us in this regard? The Third World Academy of Sciences is spending around a quarter of a million dollars to supply some of these books and journals. We need our sums of money to be enhanced by a factor of 60.

"Alternatively, the publishers could be induced to supply us, at a fraction of the cost, their publications to be distributed to the Third World — one copy of each of the scientific journals which we have identified for each of the countries — something like the Chinese prices.

"What about the book situation? We shall be listening very carefully to any ideas which anyone has regarding these problems. *We must solve this problem if Science is to flourish in the Third World."*

Trieste Resolution on Increasing the Flow of Scientific Literature to Third World Institutions

2 November 1988

Recognizing the fundamental importance of science and technology to social, economic and cultural development and to the well-being of the Earth, that the availability of scientific information is essential to any scientific and technological activity, the participants in the Workshop on Increasing the Flow of Scientific Literature to Third World Institutions, meeting today in Trieste, emphasize that it is crucial that in each developing country at least one library accessible to all scientists working in that country be kept up-to-date through the acquisition of relevant journals and books in science and technology.

Suggestions and Comments are Welcome

Would you like to express your opinion in the TWAS Newsletter? Do you wish to make a suggestion? Do you have any comments? Please write to us and let us know!

Women's Conference — cont'd from page 6

mediate formation of such an Association. After two hours of debate, a vote was taken by a show of hands accepting the following motion: "The Conference considered establishing an organization for Third World Women and Technologists, and recommends the setting up of an interim Study Group to elaborate the terms of reference for such a body. This interim Study Group, whose members are to be suggested by the Conference, will be supported by a full-time staff member based at the headquarters of the Third World Academy of Sciences. The Study Group will present its recommendations to the Third General TWAS Conference to be held in Colombia in October 1989."

Léger's Closing Remarks — cont'd from page 10

How will you organize yourselves to have more than one woman on all the TWAS committees, including the Strategic Awards Committee? How will you organize yourselves to promote women as heads of Third World organizations, who will form the new "Network" initiated here this week? How will you organize yourselves to identify specific issues to which you want to give special attention? In brief, how will you organize yourselves to take the rightful place and play your rightful role in your own countries and regions, and within TWAS? Would this imply creating your own association, or a special network, or a sub-committee within TWAS, as a means to influence decision-making bodies? CIDA will respect your decision to give yourselves the means you feel appropriate to promote your ideas and your special needs. At the same time, CIDA will give emphasis in TWAS programmes to the promotion of young women scientists, especially in the least-developed countries.

It has been an honour to have participated in this special event. I express my special thanks to TWAS, to its secretariat, and to the organizing committee.

Prof. Salam's Opening Remarks — cont'd from page 12

action needed on Science and Technology for development. 44 members of the Network, including 15 Ministers, are attending the first meeting. All in all, this meeting may be remembered by future generations as the Group of 44 meeting for Science and Technology.

We hope to have the second meeting of the Network in Bogotá, Colombia, during the period 16-20 October 1989 in conjunction with the Third General Conference of the Academy which will be hosted by the Government of Colombia, and the third meeting in Kuwait in conjunction with the Fourth General Conference of the Academy which will be hosted by the Government of Kuwait in 1991.

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