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Transdisciplinary Convergences

By F. W. G. Baker

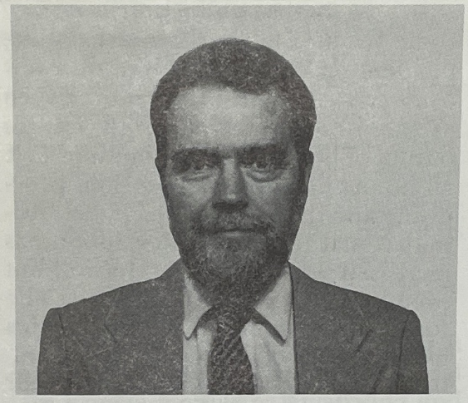
Guest Editor

As the world becomes poorer and poorer — except for human resources and their by-products — greater and greater is the need to combine our efforts to conserve natural resources and to improve our models and forecasts to help prepare for the future. Some previous articles in the World Academy of Art and Science (WAAS) News have been concerned with the types of future we may expect and the societal evolutions or changes that may accompany them. The President of WAAS has suggested that an article on transdisciplinary convergence would be appropriate to continue the series and to provide an input to the "Rethinking International Governance" project outlined in the Dec. 1985 News.

Such convergence takes many guises: within East-West and North-South cooperation, creation of organizations of regional unity, confederations of countries and organizations, convergence and consolidation of cultural, educational and scientific programmes, etc. Convergences to stimulate cooperation, create complementarity and diminish conflicts.

I will avoid dwelling at length on those transdisciplinary aspects that are talked and written about ad infinitum in the political and economic domains which are designed to bring together countries, regions, worlds of different levels of development, to create harmony and benefit all, but which tend to exclude rather than include. I will confine myself essentially to the field of science where the situation is somewhat simpler.

Attempts, starting with astronomical observations, have been made for about 250 years at the global scale to bring together scientists to study our physical environment. In the period since these began, there has been a continual convergence of opportunities and projects. The earliest to have a mixture of global coverage and transdisciplinary cooperation was the First International Polar Year (IPY) (1882-83) that created a ring of circum-polar stations and involved more than 100 stations distributed throughout the world in mainly geophysical but also in biological and anthropological studies. The Second Polar Year in 1932-33 and the third —



F. W. G. (Mike) Baker
Executive Secretary, International Council of Scientific Unions

that became the International Geophysical Year (IGY) — 1957-58 — also contributed to our knowledge of the Earth's physical environment. The IGY even increased international scientific cooperation at a time when the Cold War was at its coolest. Since 1958 we have seen a convergence of efforts in many fields of science. I will outline a few that have involved the International Council of Scientific Unions (ICSU).

The International Biological Programme (IBP) (1964-74) brought together scientists from the biosciences, chemistry, mathematics, physics, etc., in a study of the biological basis of productivity and human welfare. Before it terminated it had stimulated or spawned a number of other initiatives or global programmes including the Man and Biosphere programme of Unesco, the Wetlands project of the International Union for the Conservation of Nature and Natural Resources (IUCN) and the ongoing multidisciplinary studies of the Environment under the Scientific Committee on Problems of the Environment (SCOPE). In the earth sciences, the IGY led to the Upper Mantle, Geodynamics and Lithosphere Projects. In addition to studies to elucidate the nature, dynamics, origin and evolution of the lithosphere, the last project will contribute knowledge and techniques needed in the search for additional supplies of non-renewable energy and mineral resources and their optimum utilization and provide information that will help in the assessment, prediction and mitigation of geological and geophysical hazards.

Similarly in the atmospheric sciences, and in part as a result of UN General Assembly resolution 1802 of 1962, ICSU began a study that developed into the interdisciplinary Global Atmospheric Research Programme (GARP), a programme carried out jointly with WMO, that looked at the general circulation of the atmosphere and how to improve theoretical models so as to extend the range of worthwhile weather forecasts. This in itself led on to the Joint ICSU-WMO World Climate Research Programme (WCRP) a part of WMO's World Climate programme that also includes sub-programmes concerned with Applications, Data and Impacts.

We find another convergence in the International Geosphere-Biosphere Programme: an Interdisciplinary Study of Global Change, in which ICSU is trying to assess the future of the Earth in the next 100 years with an emphasis on the interactive biological, chemical and physical processes that regulate the total Earth system and, in particular, the processes of change on time scales of decades to centuries that are most susceptible to human perturbation. Great care will be taken to interact as needed with related ongoing programmes without duplicating or subsuming them. The convergence can be completed if we bring in climate, which is so closely linked with Global Change. One of the big imponderables is the change of yield of different parts of

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the world and even of different crops as rainfall patterns and mean summer and winter temperatures change. Our efforts to assess or analyse the impacts of such changes are still lacking precision that is required to give politicians or policy-makers confidence in our forecasts. This is another prime area where we need convergence. The interdisciplinary bridges between the natural, social and human scientists are tenuous. Earlier attempts to bring these three groups together have been less productive than many had hoped. One recent thought-provoking study of this kind is the Food and Agriculture Programme of NASA.

Agriculture and Forestry

But if there is an area in which there is an urgent need for transdisciplinary bridge-building it is agriculture and forestry, because one of the greatest problems that will continue to confront the world is that of how to provide adequately and equitably for the human population. Although many prophets blessed with an insufficiently considered degree of optimism claim that the earth will be able to feed the forecast 10 billion mouths in the first decade of the 21st century, it would seem to be in agriculture and forestry that we need the largest effort of convergence. E. Saouma, Director General of FAO wrote in the realistic report: "Agriculture: Toward 2000" in 1979:

> "Present indications are that between now and the middle of the next century . . . . . food and agricultural requirements of the present developing countries could rise five-fold. A politically and socially secure increase in supplies of this magnitude can come only from a global food system which integrates national high-productivity agricultures and provides for reasonably equitable distribution, both nationally and internationally, of income and output. This system must be established in the remainder of the present century."

In the decade or so since this was written little progress has been made in the development of a global food or forestry system, but the pressure on natural resources continues to increase and reserves of fossil fuels and fuelwood continue to decline. With global agriculture unstructured as it is today, the only chance of meeting the energy requirements — including food, feed and fuel — of 10 billion people is a concerted effort to increase sustainable production, to ensure a more equitable distribution and to provide more effective storage of food resources.

The FAO study 'Toward 2000' foresees a need for a five-fold increase in energy use in developing country agriculture by the year 2000. It also foresees a decrease in the input/output ratio with fewer calories produced per calorie of input. A question that must be answered soon is, where will the energy come from? The world is already dependent on the grain output of a few countries with high energy inputs, such as the USA, which currently has an output of 1 calorie for an input of 5, if all inputs into food production, processing and transport are included. Admitted that the Green Revolution has increased world food production but even at the oil prices of today can one foresee with optimism the investments in energy needed to increase agricultural outputs to the extent required? What we can expect is that each person will, as G. R. Hardin so aptly put it, "increase his herd without limit — in a limited world". A world that is becoming more and more limited in its resources and in which the increased herd with a series of dry years can produce a terminal stress on an ecosystem — as we have seen in a number of marginal areas, in several parts of the world.

There have been advances in agriculture since human beings adopted a settled existence. In recent decades, such advances have been grouped together to bring the green revolution which results from transdisciplinary bridges between biochemists, biometricians, botanists, chemists, geneticists and so on. Such bridges are continuing to be built. Today it is the advances in cell and tissue culture, in molecular biology, and in what the President of WAAS calls the "the indispensable cement between complex areas", biotechnology, that are beginning to have an impact on plant and animal production and in combating pathogens and pests, for example, to improve the capacities of leguminous and non-leguminous plants to fix nitrogen, to improve the efficiency of photosynthesis, perhaps to increase the uptake of CO_2, the use of monoclonal antibody techniques for diagnostic tests of pathogens, micro-injection of genes for growth hormones, etc. Can corrective action be taken in time to prevent famine on an even larger scale than we saw already in 1986? Based on our successes so far one would be tempted to answer in the negative, but based on the resistance of human populations under stress there is still a chance. We shall need, however, cooperation on a scale not so far achieved with a convergence of efforts of all facets of society. How to achieve this I know not. As the crisis — which up to now has only been marginally apparent — increases, the decision-making process will be concentrated in the heads and hands of a small number of people from a small number of nations. At the moment we seem to be in a zero-sum game in which influence or power gained by one side will be lost by the other. International bodies such as the World Academy of Art and Science should all work towards the development of a positive sum game in which the benefit of cooperation can be seen to outweigh the apparent disadvantages of competition. As E. Saouma put it: "The task is enormous but it is difficult to imagine any greater or more urgently needed contribution to the future of the world".

In 1964 J. D. Bernal wrote "We have the potentiality of the age of abundance and leisure, but the actuality of a divided world with greater poverty, stupidity and cruelty than it has ever known".

Since then almost 25 years have passed: the potentiality has increased but the harsh actuality of a divided world continues to confront us with the divisions both more frequent and more widespread. How can we create the convergence of commitments necessary — governments, agricultural, medical, natural, social scientists, corporations, bankers of different philosophies, races, cultures, etc., so as to look at the needs of the world as a whole? Unless we can bring together not only the international leaders in science, who have experience of resolving global problems, but also the leaders of many other areas, we may well come to the ultimate solution that is labelled "THE END".

The role of women in developing countries in the coming years.

By Eleonora Masini

Women in developing countries have a role which is in this specific historical moment even more clearly important to their own societies than that of women in the developed countries. This is a growing trend which I think is going to reenforce itself in the coming years and which is irreversible.

In all traditional societies women have always been the ones who, in managing the food for their families, are responsible for their survival. In fact food is first for the man who is normally the head of the family, then for the children and finally for herself. Although men are involved in agricultural production which will bring in an income for the family, women are the ones who care for the kitchen gardens and for growing the food which is needful for the family, this is true, to give a few samples, in China, in Sri Lanka, in Central Africa.

Women are the ones who take care of the health of the children and of all the elders of the family and their knowledge related to health is passed from one woman to another. It is through women that mid-wives or social workers are able to influence the health of small children whether through counselling on their nutritional needs or looking after the members of the family when ill. This is a very powerful channel for influencing many generations.

Women in developing countries have traditional meeting places like the well, where they get the water, the river where they wash their clothes, the market where they sell small amounts of vegetables, eggs and fruit which they can spare. These are the socializing places where women pass their knowledge to the younger women and the younger women ask for help, support and even comfort from the elder women. This is the traditional pattern of social behaviour in many developing countries but on this now changes are being grafted by historical processes.

The younger women in developing countries are acquiring a sense of responsibility, of awareness of themselves, of their contribution to the family, to the community, to the society to which they belong. This is something which is developing more and more, it is not something that will stop as it is at least an irreversible trend as already said.

Such an awareness appears clearly from the ongoing research project which the United Nations University is carrying out in different developing countries, such as Brazil, Colombia, Argentina in Latin America, Sri Lanka and China in Asia, Cote d'Ivoire and Kenya in Africa (1).

The project is called "Household, Gender & Age" and looks at the household as a unit of analysis the primary living unit and how it is changing because of the changes effecting women in highly rapidly moving societies. Women of different ages indicate their diverse ways of acting, thinking, aspiring in a world which is affecting all its members but in different ways according to their ages, sex as well as many other differentiations.

This is rather a new kind of research as women in different parts of the world are usually seen as emancipating and gaining their independence from men but the change which they are undergoing and which affect in their turn the household, are not so well studied. Such changes are deeper and will influence the coming generations through the changes in the household.

Major national, regional and global events are not usually analysed for their effect on women such as changes in technologies in the textile industry as analysed in the case in Brazil and Argentina within the project of Household, Gender & Age, or the migration of women from Sri Lanka to the Middle East which is the case studied in that country or the changes in the economic and social structure of the rural communities in China or the building of a dam in the Cote d' Ivoire. Such major events important for a country as a whole, do not seem to influence directly women while they do affect them in ways which are even deeper than behaviour, such as aspirations, wishes, desires which are influencing the household and the other members of it in deeper and longer effects.

The changes occurring in the environment, as in the case of the dam in the Cote d'Ivoire, where villages are displaced and undergo incredible changes in the economic and social structure affect the ways of life specially of women who will have to adapt to such changes in terms of their work, of domestic work, (cooking, washing, taking care of the children). Many changes are not only economic, but mainly deep-rooted cultural changes. When technologies in an industry, like the textile industry occupying mainly women change, then the ways of life of the women also change and this means usually changes in the household and even in the community.

Many researchers and policy orientated researches have to be undertaken with analysis not only of the great changes at the macro-level, but in terms of what these do to the social structure, to the political attitudes, to the economic development, but also, and most importantly, I think, in terms of the primary living unit which is the household. The household whether extended and patriarchal as in the rural areas of the developing countries, or tending to the nuclear, as in the urban areas, are affected by the changes which women themselves produce and not only accept passively as so often it has been thought. Such changes have to be taken into consideration as they are deep-rooted and are less visible than economic or structural changes but are deeper and slower in occurring as well as longer in staying. Cultural changes are in fact less visible than technological or economic changes, as they are less abrupt, less accountable for and not linear by definition as they are related to value changes and they may take a long time, sometimes one generation, sometimes less but they always need years. As an example the world trend towards two children per family which is now recognized by scholars will take time and is related very much to the women's behaviour and to the changes in the household relationship. Another interesting example is the emergence of different types of household which are neither nuclear nor pa-

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(1) Household Gender & Age, September 1986, United Nations University.

In transition.

Carl-Göran Hedén

USSR.

The long sequence of events, of which the Issyk-Kul Forum (cf. December 86 Newsletter) was one, culminated in Moscow February 14-16th, in a series of major conferences on nuclear disarmament.

As a professor from Karolinska Institutet in Stockholm I had been invited to participate both in the Forum of Scientists and in the Forum of Literary and Artistic Personalities. At a reception in the Swedish Embassy in the evening of February 13th, this gave me an opportunity to hand over the WAAS-scrolls to a few Soviet Fellows, namely A. P. Alexandrov, G. K. Skryabin and S. Kapitza. C. Aitmatov, who was the organizer of the Forum of Writers (cf. photographs), however had to be excused due to a meeting with Mr. Gorbachev's deputy. When I arrived in Moscow he asked me to introduce his session, which I did by the address which follows, since it has some bearing on the WAAS-symposium "New Paradigms — the World Three Hundred Years After Newton" (Lisbon, May 10th, 1987). I called it "A Synopsis for a Fairy Tale".

Speaking to such an illustrious group of writers and artists, as the one gathered here, is no easy matter for a scientist. In fact, I regard myself as a trespasser from the Forum of Scientists, but also as a representative for many people who feel that it is now high time for us to bridge the gap between what C. P. Snow called "The Two Cultures".

Inspired by a long taxi-ride I had with Mr. Aitmatov the other evening, I now want to make some general observations that lead up to three unrealistic — but I think thought-provoking wishes — that I would address to the Good Fairy of our childhood tales, if she would happen to show up in our troubled times.

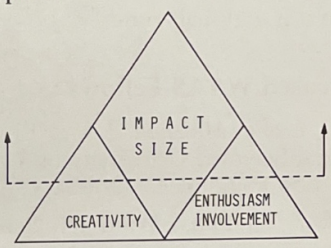
Those are times when not only the USSR is entering a phase of transition. In fact, I agree with Mr. Aitmatov, when he just reminded us of the fact that we may all be living through a paradigm-shift, which makes a break with the 300 year old Newtonian heritage of reductionism and linear predictions. It shakes even the foundations of traditional economics, which as one example has of course always taken the environment as a given.

Academician Chinghiz Aitmatov seated between film director Elem Klimov (on his right) and Bogdan Suchodolskij at the Forum: For non-nuclear world, for survival of mankind.

In an interdependent world, with instant communications, we now dimly realize that not only the interactions between stock exchanges, but also between poverty, unemployment, demographic stresses, criminality, drugs, racism and eroding family-ties, can all lead to various unexpected and uncontrollable domino-effects.

In such a fluid environment, traditional hierarchical structures (in companies, in municipalities, in governments and in international organizations) show their vulnerability, because they always tend to loose their vitality with time. This can be illustrated with what I like to call the bureaucratic petrification triangle.

In this diagram the organization is represented by a horizontal line which gradually moves upwards. Initially the proportion of creativity and personal involvement is very high, in comparison with the impact and size of the organization. However, the latter grows as creativity and involvement diminish. When they are finally exhausted, the organization seems to be at its peak, but the first symptoms of decay also start to appear.



Cluster of Technical Inventions
Agriculture
Food storage
Canning, antibiotics and vaccines
Cheap energy technologies
Bio-and information technologies

Impact
The permanent settlement
The city
Worldwide military activities
The Consumer Society
The Concerned Society

Examples of Social Innovations
Division of Labor
Hospitals
United Nations
GATT
The Open University

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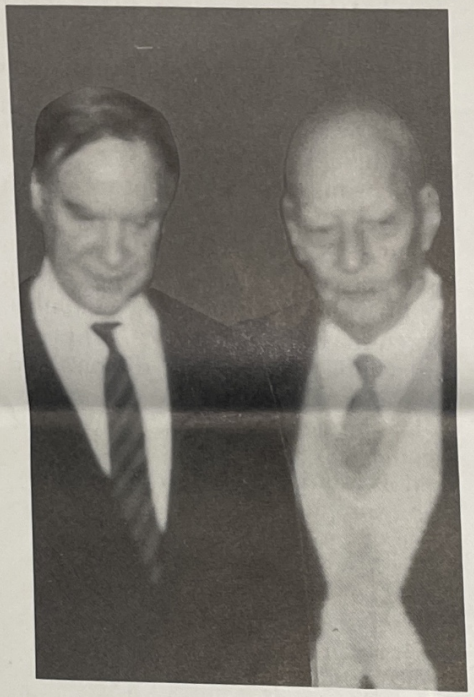
One is what I call "the Lunch Syndrome", often seen at the board meetings of large high-tech corporations. They are dominated by legal-and financial transaction experts who sit on a large number of boards. Consequently they are so busy, that they normally only have time to scan through the background documentation in the plane on their way to a meeting. This is why they listen so carefully to what their partners have to say at the board lunch, where everybody believes that the others have read the papers. This is of course not the case, which gives the managing director, or rather the secretariate which prepared the briefing material, abnormal powers.

Another symptom of petrification is the development of a "Personal Interdependence Network" which is a strong conservative force which tends to counteract all sorts of social innovations.

We become used to the fact that social innovations appear as adjustment phenomena brought about by the impact of technical inventions.

However, in the interest of survival, shouldn't we now try to anticipate future social needs and use our creativity to foster those particular technical inventions that will effectively meet them.

More and more technologies will obviously not provide the answer to our problems, as illustrated by the old question: "suppose a man can dig a ditch 10 meters long in one hour, how long a ditch can he dig if you give him two shovels"? The fact that the answer is obviously less than 10 meters should make us realize that technology must be tailored to Man, if it is going to be of any use at all. If the technology goes beyond the average man's comprehension, and in addition is governed by experts in distant places, this gives rise to insecurity and this, in its turn, breeds distrust and inaction. Needless to say, this brings education and information into focus, but also the need to generate enthusiasm (from greek: "The God Within"), which I think is the inescapable result, when Man gets a chance to express his creativity. This is why writers and artists are such singularly important catalysts in any society. The problem, as I see it, is that they normally confine their creativity to the needs of the mind, and do not readily mix with the scientists and engineers who try to understand and manipulate the physical world. Mix the two, as we try to do in the World Academy of Art and Science, and some useful social innovations might emerge.



Professor S. Kapitza and Academician A. P. Alexandrov at reception in Swedish Embassy in Moscow.

Coming from a country where many people are involved with the management of Nobel Prizes, it is natural for me to think of this institution as a social innovation. However, we should ask ourselves if the time has not come to supplement those retrospective awards with prospective ones: awards aimed at directing the attention of many creative minds towards narrowly defined targets. After all, we know that canning was invented when Napoleon announced an award to anyone, who could help him feed his troops in the course of long military campaigns. First man who flew across the English Channel with muscle power had his mind set on getting a large money award.

Thoughts like those made us try an experiment in Sweden that ended last summer. We then celebrated the 100 year anniversary of the Swedish Inventors' Association by awarding prizes for inventions aimed at narrow targets related to needs of developing countries, as defined ten years earlier (areas: Water, Industry, Forestry and Energy). This was a successful exercise that it lead to my first wish to the Good Fairy.

It is simply that she uses the Vatican system for electing Popes, and locks the decision makers of the super-powers up in a room, from which she would not let them escape, until they had reached agreement. Their charge would be to define targets for those technical and social inventions that would best serve the poor countries of the world, when they enter the next century. An Awarding Ceremony then, at the opening of the first UN General Assembly of the next Century, I think might have a salutory effect on our politicians. They often need to be reminded of the fact that the world is not only a chessboard for the power game, but also the scene for those creative individuals who shape our future.

Also my second wish to the Fairy would focus on the individual, and especially on the friendly interactions between people, which tends to develop whenever it gets a chance. I would ask the Fairy to create "an Island In the Sun", off-bounds for the newsmedia, where the wives and children of our heads of state and ministers of defence would spend a few holiday weeks together each year. The reason is simply that I would like to create a psychological inhibition in people who have the dreadful responsibility of pressing "the red button" for mutual destruction. Isn't it likely that more than seconds and minutes would be gained if they — for their inner eye — saw their friends, and perhaps even their grandchildren, at the receiving end of their missiles?

My third wish to the Good Fairy is even more unrealistic I am afraid, because old-time fairies can't be expected to be much better at nuclear physics than I am. Anyhow, I would test her ability by asking her to give the International Atomic Energy Agency in Vienna a money-making present. It would be a breeder reactor put right across the border between East and West. It would have one entrance facing east and another west, and it would sell electricity by burning plutonium. If one kilo from the West was processed for each kilo from the East, it would feel me more secure than signatures put on pieces of paper in Geneva or New York!

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triarchal, as in China where the two generation or the one generation couples co-reside.

These are some of the indications of changes which are emerging from the research undertaken by the United Nations University which is still in progress but which I believe will indicate for researchers and policy-makers some important trends which do not seem easily detectable but which are most important as deep-rooted changes of our present and future societies.

As Co-ordinator of Household Gender and Age project of the United Nations University, the experiences of seeing the growth of awareness and responsibility of women in different parts of the world, whose life does not become easier with the new technologies but which indeed is not one of subjugation and passivity anymore, is very interesting. I believe that the research can show a clear trend towards greater responsibility and awareness of women, trend which is irreversible and means that women's participation in social changes is not only in the household but also in the society as a whole and as such it is a global trend.

Deceased WAAS Fellows

Prof. Leona Marshall Libby, Environmental Science, University of California, Los Angeles, CA 90024, *U.S.A.*

Prof. Felix Mainx, Wien IX, Schwarzspanierstrahe 17, *Austria*

Prof. Elmer Szadeczky-Kardoss, Muzeum Konu Konut 4/A, Budapest, VIII, *Hungary*

Prof. Albert Szent-Gyorgi, Marine Biological Laboratory, P.O. Box 187, Woods Hole, MA 02543, *U.S.A.*

Exploring Ruins Around The World

Florence M. Hetzler

Ruins may be considered as a form of art; but unlike painting, sculpture or music they have not been studied as such to any great extent, except that painters, poets, and writers have occasionally included ruins in their works, expressing the interaction of the forces of nature with the works of man.

Professor Stacy Day, WAAS Fellow, talking with Professor Thomas Lambo, Deputy Director General WHO, before receiving the WHO medal for Meritorious International Medical Services.

Notice to American Fellows

Fellows contemplating gifts to the World Academy or familiar with donors wishing to make such gifts are advised that changes in United States tax laws, which go into effect in 1987 and the year after, make FY 1986 a preferred year for donations. Cash contributions will provide more benefits to donors this year than in future years. Appreciation on contributed property will not be taxed as income this year but will be figured in future years. The American Division of the World Academy has tax exempt status and can receive charitable gifts. Particularly, the project on Pain and Stress Management is now entering a phase when outside sources of funding must be sought. Those who wish to make such gifts or discuss the matter further, may contact the Treasurer, Richard Palmer, Public Ledger Building, 956, Philadelphia, PA 19106, USA, (215) 625-9900.

New WAAS Fellows Elected December 1986

Chingiz Aitmatov, Kirgizhia, USSR — Academician A.P. Alexandrov, Moscow, USSR — Carl Sagan, Ithaca, NY — Academician G. K. Skryabin, Moscow, USSR

Ronald Reagan, President of the United States wrote to Dr. Stacey B. Day as follows:

"The vision of Dr. Stacey Day, and his fine team at the center, builds on a community approach to medicine which is truly international in scope. The effort to bring outstanding medical care to other nations and to help them implement effective health service programs for their peoples is vitally important. It blends deep human caring with the most up-to-date medical techniques, while acknowledging the social differences among nations and the need for medical services which enhance the lives of all and recognize their innate worth as human beings."

Excerpts from 1969 WAAS Newsletter

by Stuart Mudd, Deceased

The understanding to be sought embraces the ecology of our entire planet, the well-being and quality of life of all mankind. The understanding should include the religious insights and aspirations of man, the verified discoveries of science, the useful applications of technology. The goals should be optimally viable economic and social organization in relation to the entire planet, the good life for all mankind; for the unit of survival in the presently emerging world is not one particular religious, ethnic or political group, but *Mankind.*

Stuart Mudd