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SCIENCE FOR PEACE *series*

SCIENCE FOR PEACE

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International Symposia on Science for Peace

Hebrew University of Jerusalem - Jerusalem, Israel
First Symposium - 11 December 1995
Second Symposium - 20-23 January 1997

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INTERNATIONAL SYMPOSIA ON SCIENCE FOR PEACE

First Symposium: 11 December 1995
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The UNESCO-Hebrew University of Jerusalem,
International School for Molecular Biology and Microbiology

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EditorÕs Note:

The Editors of Volume No. 3 of the Science for Peace Series, consider the papers presented at the First Symposium held in 1995 still relevant and therefore this volume contains the materials of two symposia held at the UNESCO - Hebrew University of Jerusalem, respectively in 1995 and 1997.
The papers presented during the First Symposium in 1995 are indicated by an asterisk (*).

CONTENTS

B. SCIENCE FOR PEACE IN THE BIOLOGICAL SCIENCES

C. SCIENCE FOR PEACE IN THE MIDDLE EAST

* Participants of the First Science for Peace Symposium

Introduction
The Series of International Symposia on Science for Peace

Yechiel Becker
Director, UNESCO-HUJ ISMBM, Israel

The UNESCO-HUJ ISMBM had initiated its activities in December 1995 with the first International Symposium on Science for Peace. It was thought that the International School was established to enhance the UNESCO Culture of Peace Programme, to support the Middle East Peace Process and to develop into an avant-guard school where scientists from the fields of Molecular Biology, Microbiology and the field which derived from them like Genetic Engineering will interact with physicists, chemists, computer scientists to develop interdisciplinary scientific activities on the cutting edge of sciences.

Past and current scientific activities that advanced our knowledge in physics, lead to the development of atomic bombs and of nuclear reactors for production of energy for civilian use. Microbiology had lead the way to identify pathogenic agents as small as prions, viroids, viruses, bacteria, parasitic protozoa and helminths and to the discovery of antiviral antiparasitic and antibacterial drugs. On the other hand, biological weapons were developed. Molecular biological research led to the development of genetic engineering technologies and to the human genome project which soon will decipher the 100,000 human genes and will improve the diagnosis of inheritable genetic disorders and their cure. On the other hand, there is the cloning of sheep which unraveled a technique that may lead to cloning of higher evolutionary species.

It is necessary to encourage scientists as part of their academic training to realize their responsibility to the protection of the human race and the environment, and to contribute to the improvement of the quality of life internationally and to the sharing of the benefits of scientific developments by all the peoples on earth.

These ideas are the basis for the International Symposia on Science for Peace.

A. SCIENCE FOR PEACE

The Jerusalem Statement on Science for Peace

Occasion for the Preparation of the Statement

Members of the international scientific community met in Jerusalem, Israel on 20- 23 January 1997 to participate in the Second International Symposium on ‘Science for Peace’. The Symposium was organized and hosted by the UNESCO-Hebrew University of Jerusalem-International School for Molecular Biology and Microbiology (ISMBM) with additional support from UNESCO (Paris, its Venice Office, the Global Network for Molecular and Cellular Biology), the International Institute of Theoretical and Applied Physics (IITAP) at Iowa State University and the Hebrew University of Jerusalem.

With the background of the UNESCO charter and several important international documents addressing the social and ethical responsibilities of scientists, we heard presentations and discussions of how scientists can work for peace and the beneficial utilization of scientific results. This Statement on Science for Peace resulted from the presentations and discussions which addressed both the current situation in the Middle East and a broader set of geographical situations.

In 1989, UNESCO accepted the Seville Statement on Violence (1986) which included the responsibility of scientists to prevent the misuse of scientific concepts to justify domination and violence. UNESCO sought to convince the public that “the same species who invented wars is capable of inventing peace” since peace begins in our minds, thus paving the way to the UNESCO Culture of Peace Programme.

In 1995, during the 50th Anniversary of the United Nations, representatives of the world’s major Academies of Science and international scientific community issued the Genoa Declaration on Science and Society. In the Genoa Declaration they assert their adherence to the principle of "respect for diversity of cultures within societies and promotion of science as a distinctive and important contributor to bridging such diverse cultures and promoting peaceful coexistence in accord with the principles of freedom, autonomy and rationality."

UNESCO promoted a Forum in 1996 in Como to further reflect on these issues. The resulting Como Declaration on Science, Society and Ethics further addresses the role of science for providing an important paradigm for Culture of Peace in the areas of disarmament and reconversion.

The Jerusalem Statement on Science for Peace

We, members of the international scientific community from different scientific backgrounds, gathered in Jerusalem, address this appeal to all individuals and institutions working in science and for science. As the language of science is universal and cooperation in science builds important bridges of communication, we appeal for increased and unified efforts to adopt Science for Peace as an important goal in concert with the goal of fostering a Culture of Peace.

We recommend that all parties and especially scientists work to ensure that:

1. scientific endeavors and achievements be used only for peaceful purposes and for the greater benefit of humanity;
2. there is free movement of members of the academic community;
3. there is a free flow and sharing of scientific information and knowledge;
4. the academic environment remains open and dedicated to the free expression of ideas.

We recommend that efforts be undertaken to develop a "Science for Peace Oath" for young scientists to take when accepting their degrees. This oath could be similar to the Hippocratic Oath which is taken by health care professionals.

From Jerusalem, the City of Peace, we call upon everyone to work for the rapid implementation of these ideals to further enhance the peace process. We encourage commitment and action to remove obstacles to these ideals.

We request that UNESCO, governments and other organizations facilitate the achievement of the recommendations of this document.

Recommended Actions for the Middle East

This Science for Peace symposium was a unique opportunity for creative suggestions and concrete proposals to be presented and discussed by representatives with different backgrounds and perspectives from the Middle East. In light of these presentations and discussions, and in order to achieve the recommendations of the Jerusalem Statement on Science for Peace, we recommend that all institutions, especially UNESCO, become involved and supportive of:

1. specific actions to foster mobility and increased contacts among all members of the academic community in the region;
2. the establishment of a world class international institution of higher learning and research in the Middle East open to all students, educators, researchers and administrative members without regard for nationality, country of origin, political beliefs, religious faith or gender.

From the outset, this international university would be especially dedicated to finding transdisciplinary solutions to the human resources, development and social needs of the area.

The participants of this Science for Peace symposium dedicate themselves to work within their own institutions and governments for these goals.

We propose, as an immediate step, the formation of a working group by UNESCO, in order to plan the process for achieving these goals in the Middle East. The committee should include an appropriate distribution (gender, race, religion) of representatives from the academic communities of the Middle East as well as outside the region.

Jerusalem, 23 January, 1997

The Deep Structural Relationship Between Culture of Peace and Culture of Science

David Adams
Senior Programme Specialist
UNESCO Culture of Peace Programme

The concept of a culture of peace was formulated for UNESCO by the International Congress on Peace in the Minds of Men (Yamoussoukro, Cote d'Ivoire, 1989). In its final Declaration the Congress recommended UNESCO to "help construct a new vision of peace by developing a peace culture based on the universal values of respect for life, liberty, justice, solidarity, tolerance, human rights and equality between men and women". The Yamoussoukro Declaration recognized the Seville Statement on Violence (1986) as an important foundation for its work. This statement, written by scientists following consideration of the available data, rejected claims that war is inevitable because it based on biological factors (genes, brain mechanisms, "instinct for war", or "human nature") and concluded that "the same species that invented war is capable of inventing peace.". Hence, from its founding, the UNESCO Culture of Peace Programme was closely related to the work of scientists.

UNESCO has engaged in activities to promote a culture of peace from its beginnings, when it was founded in the aftermath of the Second World War to construct the defences of peace in the minds of men and women. However, with the end of the Cold War and the new political and social world order which followed, it was evident that a new effort was needed that would give UNESCO as well as the international community the instruments to transform the still dominant culture of war into a culture of peace. Hence, in October 1992, the UNESCO Executive Board proposed a UNESCO programme which would undertake activities of reconciliation and cooperation in countries where United Nations peace-keeping operations had been implemented or could be anticipated.

The first three National Programmes of Culture of Peace were initiated in El Salvador, Mozambique and Burundi. These programmes are based on a process of participation, dialogue and cooperation of all parties to the conflicts in the countries concerned. In addition, support has been provided to the National Culture of Peace Programme that is being undertaken by the Philippines. Colloquiums have been held to develop the process of cooperation and participation of all parties to the conflicts in Congo, Sudan, and Somalia, laying the base for culture of peace activities in those countries. Also, a national culture of peace programme is presently under development in Nicaragua and requests for culture of peace initiatives have been received from a number of other countries.

In 1995, the UNESCO Culture of Peace Programme was expanded by the Organization into a Transdisciplinary Project which involves all of the sectors, including those for education, culture, communication and social science, in a global approach to promoting a culture of peace. This requires transforming all of the values, attitudes and behaviours which have been developed in the culture of war. Its aims are to 1) change the concept and practice of power from violence and force to non-violence and respect for human rights; 2) reform authoritarian structures and exploitation to democratic participation and sustainable human development for all; 3) replace male domination with full equality of women and men; 4) counter secrecy and the manipulation of information with participatory communication and the free flow and sharing of information and knowledge; 5) convert enemy images and distrust of others to understanding, tolerance and solidarity among all peoples and cultures.

One recognizes in this list of aims a great deal of parallel between a culture of peace and a culture of science.

1. The emphasis on non-violence is related to the fundamental characteristic of science, which is that a scientific law cannot be imposed by force, but only by convincing others of its truth. Whenever in history there have been attempts to force scientific conclusions upon an unconvinced community, the results have been disastrous, both for the scientific establishment and for the culture as a whole. In fact, it could be argued that practitioners of non-violence can learn from scientists how to present a convincing case in trying to convert their opponents to change their minds. It is necessary to carefully explain the methodology employed to arrive at the conclusions, and to convince the other that it is to their benefit to share this truth.

2. The emphasis upon development for all in the culture of peace may be related to the question of the uses of science. If science is used for destructive purposes or for the exploitation of some by others, it is not within the proper ethical framework to which it should be dedicated. Just as medicine has its Hippocratic Oath, by which the physician commits himself or herself to the use of medicine for the benefit and not the harm of others, would it not be appropriate that the scientist take and follow a similar commitment?

3. The equality of women and men is now generally assumed in scientific work, so much so that it need hardly be questioned. However, in many societies there is not yet as much access of girl children to education, including scientific education, as for boy children, a situation which robs science of its full human potential.

4. The free flow of information is a fundamental characteristic of both a culture of peace and the culture of science. This is so evident as to be a truism. If there is any essential aspect of the scientific method, it is the full communication among scien-

tists of methods and results, putting them into an historical context in which it is acknowledged that the work builds on the shoulders of those who have gone before and contributes to the work of those who will come after. Whenever there is secrecy or manipulation of information, it produces a distortion of the scientific system, which at best negates the value of the work done and at worst produces false starts and setbacks for the entire scientific community.

5. Science is a universal search in which there is no “them” and “us”, no “friend” and “enemy”, but a single, international process in which all humanity may take part regardless of race, sex, religion, national identity, or any other divisive label. Scientific truth is as true if it is demonstrated in one country as it is in another. It is a universal, and as such, it encourages the universal understanding, tolerance and solidarity which is characteristic of a culture of peace.

Given the deep structural relationship between a culture of peace and the culture of science, there is good reason to expect scientists to contribute in their capacity as scientists to the peace process, and that they should be mobilized to this end.

Peace is Scientifically Possible: From the Seville Statement on Violence to the UNESCO Culture for Peace Programme

J. Martin Ramirez
Universidad Complutense Madrid, Spain

It is an honour and privilege for me to be invited to participate in this Symposium of "Science for Peace", held in Jerusalem, the City of Peace. We have the more than laudable aim of letting everybody -people and institutions at all levels- know that scientists have a very important role in assisting the achievement of the peace process, particularly here in the Middle East. I would like especially to thank its main covenor, Prof. Yechiel Becker for his efforts in making possible this UNESCO-HUJ School, and to the Advisory Board from UNESCO who have helped him in its organization. I am grateful as well as to Vladimir Kouzminov for his effort on the publication of the Proceedings.

As covener of the Seville Statement on Violence (1986) in which scientists from all the world and from many different disciplines stated that peace is possible, that the world can be without war, I am going to dedicate the core of my intervention to make a short historical comment on its genesis: which were the main reasons which urged us to elaborate the Statement, difficulties we found on the way and how we finally achieved that first 'scientific' step towards peace. This has been succesfully followed by the creation of the UNESCO's Culture of Peace Programme (1994), and with the Jerusalem Statement on Science for Peace that we are ultimating during these present days. Since it has been already established that peace is scientifically possible, I will go further into the next step giving some suggestions about where and how to find the peace we scientists are looking for.

For the psychobiologist who studies brain mechanisms supposed to be involved in aggressive behavior, conceptual as well as ethical problems arise from the fact that research dealing with brain-behaviour relationships is both a research endeavour like any other and one that clearly differs from many others. It differs in that the data obtained, the interpretation given and the generalized conception of brain-behaviour relationships that is derived from them, contribute to shape our vision of man, his 'nature', his being and his evolution. Conversely, this vision of ourselves, of our supposed 'nature', is bound to somehow orient -unconsciously, or more deliberately- the way in which we construct the conceptual framework within which we elaborate our working hypotheses and how we interpret the results obtained when verifying them. It matters all the more to be fully aware of these reciprocal relationships between personal convictions and actual scientific endeavour since our basic interest lies in a deeper understanding of the biological determinants of our own personality and behaviour, even though our experimental analysis is carried out -for obvious ethical reasons- on the brain of some animal species. The true weight and the real influence of our personal convictions clearly appear when, on the basis of one and the same array of available facts, but, admittedly, with selective emphasis put on some of them, some feel entitled to deliver, with regard to human aggression and violence, a 'message' of necessity and fate, while others are led to deliver one of freedom, responsibility, and hope (for more precise questions related to this topic as well as many relevant individual features fruitfully subjected to psychobiological investigation see: Karli, 1996).

Some people say that war and violence cannot be ended because they are part of our biology, in the same way that they used to justify slavery and racial or sexist domination by claiming that they were biological and inevitable. In the same way that they were wrong in these latter justifications, it is also scientifically incorrect that peace is not possible. Therefore, we thought that it was our responsibility as scientists to speak out on the basis of the latest information, although aware that conclusions in science are never final. The elaboration of a document stating the scientifical state of art on the field of human aggression and violence would give a needed message of hope to humankind, as opposed to the myth that it was something naturally inevitable. The obstacles found in our attempts, however, illustrate the extent to which ideological preconceptions often interfere with an actual scientific endeavour. I want to mention briefly some events objectively revealing.

In the late seventies, the International Society for Research on Aggression (ISRA) decided to launch a UN-Committee that, among other goals, would aim at organizing a series of symposia under the auspices of UNESCO. It was hoped that these symposia would eventually lead towards a UNESCO statement on human violence, following the example of what had previously been achieved by UNESCO with regard to the notion of 'human race'. A provisional programme was drafted and submitted to UNESCO. Both, our Swiss colleage Pierre de Sénarclens, at that time head of the Division for Human Rights and Peace, and Mr. M'Bow, Director-General of UNESCO, responded in a most favourable and encouraging way. But then, highly polemical discussions took place within UNESCO concerning our proposal, to the extent that Pierre de Sénarclens resigned from his UNESCO position (he went back to Lausanne to resume his teaching of political sciences) and M'Bow sent a second letter telling our President that the proposed topic was too 'touchy' to be dealt with under the auspices of UNESCO.

Some time later, Carlos Chagas, at that time President of the Pontifical Academy of Sciences, invited us to draft a motivated proposal for a Symposium devoted to “the biological and socio-cultural determinants of human violence”. We soon heard from him that the Pope had read the proposal, that he fully approved of both its structure and general spirit, and that he encouraged us to proceed. And then, after a long silence, we learned that the Pontifical Academy had come to the same conclusion that as UN-ESCO: it was not timely to deal with the determinants of violence.

However, instead of giving up, we -scientists from very different disciplines- kept discussing freely, openly about it. The main question we wanted to answer was whether modern natural and social sciences knew of any biological factors that were an insurmountable or serious obstacle to the goal of world peace? Efficiently coordinated by David Adams, professor at Wesleyan University, -at that time the mail connections were not easy at all among people geografically scattered throughout all the continents, when fax, e-mail or internet were not existent yet- we exchanged the latest information about animal behavior, psychology, brain research, genetics and other related sciences. Finally, a draft was elaborated and sent to all of us for its study. Then, around twenty of us met in Seville and La Rabida, just from where Columbus started his discovering trip to the New World, and after one week of practical seclusion, the final Statement on Violence was born. It was May of 1986, the International year of Peace. Afterwards it has been endorsed and published by many scientifical organizations around the world, and the very UNESCO, by decision of its General Conference at its 25th session (Paris, 16/11/1989), ordered its dissemination.

In plain words, the Seville Statement on Violence says that peace is possible and that wars and violence can be ended, making clear that there is nothing in biology that stands in the way of making a world without war.

War is not in our genes, as stated very expresively by Eibl-Eibesfeldt (1979), and we need not accept human aggression as a fate; as the Nobel Price winner Lorenz pointed out, “we shall not improve our chances of counteracting [intra-specific aggression] if we accept it as something metaphysical and inevitable, but on the other hand, we shall perhaps succeed in finding remedies if we investigate the chain of its natural causation" (1963). Far from condemning humanity to war, thus, biology makes it possible to end violence and the suffering it causes and, consequently, to achieve peace (see: Adams, 1991; Ramirez, 1994a, 1996a).

* * *

Obviously achieving peace is not an easy task at all, even if the wish for peace expresses a much felt need in our days. This first step -peace is scientifically possible- is necessary, but not enough. A second important step has to come. Once we know it is possible -it must begin in the mind of each person with the belief that it is possible -, the challenge now is to counteract the prevailing culture of violence which has pervaded so many societies and to transform it into a culture of peace. How to contribute towards this transformation? One way is to find permanently shift attitudes, values and behaviour in order to promote peace and social justice, and the non-violent resolution of conflict and security through a transdisciplinary approach. This primary scope, which is the aim of the UNESCO's Culture of Peace Programme, requires cooperation at all levels, everyone working together for peace and reconciliation.

Within this universal and transdisciplinary task for constructing peace, scientists also have a specific role to play. Given the interesting and precise suggestions on the topic made throughout the present Symposium, and more specifically in the Jerusalem Statement on Science for Peace here elaborated, it suffices to add only a couple of specific comments. First, we have to understand the problem and its possible solutions: to know what is aggression, violence and war, and what peace really means in its deepest meaning, as well as which are their interacting biological and cultural factors. And, second, we should emphasise the potential value of education, specially during the early critical periods of development, to provide a major contribution to the control of aggression, in the prevention of violence and in the achievement of peace, stressing the importance of a comprehensive and global education with a transdisciplinary approach. We should convince the society about the benefits of investing adequate resources in such extensive educative efforts, instead of limiting its resorts to threats or punishment to control aggression.

* * *

While problems are relatively obvious -even if you are not in direct contact with aggression, you often can be indirectly affected-, effective resolutions are not. They depend on understanding problems. A most effective means of understanding them is its systematical study, utilizing scientific techniques. For example, in our case, with a greater knowledge of the many causes of aggression, we can develop an appreciation of the possibilities for controlling it, as well as an understanding of some of the reasons why we have failed to effectively control it in the past, such as a lack of its appropriate definition and measurement (see: Ramirez, 1997). Here I will just say that biology and environment taken separately are never causes of anything in an organism's development. Therefore, the human brain should no longer be considered as a generator of possible -or even inevitably- occurring aggressive behaviour (with improper emphasis on some humoral factor or even single gene thought to be specifically implicated), but rather as the mediator of a dialogue which may take on an aggressive form for reasons that can only be truly clarified through joint multidisciplinary efforts.

An adequate control of aggression is certainly a reality in innumerable discrete settings, and it is not an unrealistic goal for a society. Since there is no one factor that overhelmingly produces aggression, what we need is a comprehensive approach, integrating different perspectives on violence, with an appreciation for the various objectively supported contributions of biology, learning mechanisms, social experiences and what is more important, their dynamic integration. If we maintain our present course in our research for causes of aggression, we will surely fail. This assertion can be described in no better way than with an extrapolation of the image constructed by McCord: Why is the sapling outside your window the way it is? What has determined its odd shape, its slow rate of growth, the way it leans, its anemic look despite the luxuriant foliage of your neighbor's tree? Whatever your answer, it will be inadequate (for your understanding of the tree, and for devising well-placed efforts to assist its growth) if you take into account less than everything that influences development. You may know all about floral morphology and chemical processes, about the amount and rate of nutrients it received since it germinated, all toxicants against which it struggled, and variants in its exposure to sunlight, but you will not understand this tree if you know nothing about its ecological history, about the molecular processes with which it was endowed. Our purpose has to be to begin the process of integrating the various domains of science that are studying the development of aggression and peace, in an attempt to use science to guide society in its efforts to prevent and control harmful aggression. Even if basic scientists may have the luxury of separate the biology of aggression from its psychosocial and environmental context with questions arising within their isolated domains; if we want to reach the ultimate goal of application of scientific information in the real world we can never separate them. There is a constant and circular interaction. As Craig Ferris says, "Development is 100% environment and 100% heredity", in a dynamic interaction (Grisso 1996).

* * *

This bring me to the next major feature. If we want to achieve peace, we first need to know what peace really means in its deepest meaning. According to Pope Paul VI, the new name of peace is ‘development’ because, if we understand as peace the harmonic whole of all what people need, personally and socially, for their happiness, development is a very good way for achieving it. Development embraces dimensions so distinct and integrated as culture, economy, education, politics, promotion of the weakest, respect of human dignity and human life, as well as a profound respect for the environment in which we live. An optimal approach towards peace, therefore, would be to prevent the problems of violence and war, for example, with a political, cultural and economical intervention, alleviating the poverty and other social conditions that breed these problems (Ramirez, 1996b). A true peace thus has to be supported by a real development of the humanity subordinating all goods and technic resources to the human dignity, the only sure foundation on which to lay a better welfare state, a happier society and a more pleasant life.

How can we achieve peace if we don’t realize that we are all ‘one’? Only by fostering an environment that breaks down barriers, whether they be moral, religious, economic, etc., and by seeking the ‘substances’ that are similar to and unite all instead of those that divide and separate. How can we pretend that the new generations become more tolerant, asks John Elliot, Regius Professor of History at Oxford, if ignorance brings naturally to mistrust and even to hate? Since we would like to live in a permanent state of peace and well being, we have to lay down solid foundations to make peace education available (Ramirez, 1994b). Education becomes a preventative measure that informs individuals and caregivers about the causes of aggression: starting with pre- and postnatal health care, it would progress through the raising and formal education of children, and continue into adult social settings. Besides the formal education, one needs to learn how to deal with emotion, how to transform anger and fear into love and compassion, how to communicate positively with others and become happy.

An important aspect of this global education is the schooling the emotions, given the influenciability and molding of the feelings, especially during the early years. The affective education movement of the 60's -psychological and motivational lessons were more deeply learned if they involved an immediate experience of what was being taught conceptually- has rather become the emotional-literacy movement of our days: instead of using affect to educate, it educates affect itself. Prevention programs are far more effective when emotional and social competences are taught: such as impulse control, managing anger and finding creative solutions to social predicaments. Emotional skills have to be also stressed: self-awareness, identifying, expressing and managing feelings; impulse control and delaying gratification; and handing stress and anxiety. (Goleman,1995)

Chronic anger is an habit that also can change through education: for example, teaching basic elements of emotional intelligence, particularly mindfulness of anger as it begins to stir, ability to regulate it once it has begun [substituting reasonable thoughts for cynical, mistrusful ones], and empathy [for frustrating encounters, you learn the ability to see things from the other person's perspective]. As Redford Williams says (1989), "the antidote to hostility is to develop a more trusting heart. All it takes is the right motivation. When people see that their hostility can lead to an early grave, they are ready to try".

Conflict resolution is another interesting point which can be meliorated via education, learning the many choices for dealing with conflict besides passivity or aggression. Given the futility of violence, it has to be replaced with concrete skills. When tension erupts, you can seek out a mediator to help settle arguments that otherwise can escalate. You have to learn to think differently about disagreements, and to recognize an expanded range of feelings. And patience must become an habit which will make us able to deal with life more ‘peacefully’.

* * *

I am aware that it is easier to write about peace than to achieve it. What it is difficult is to apply it into our mind and hearts. Even if until now we have not had time for peace, the time has come to take on the committment to heal ourselves, our society and the world by the power of the truth, especially through science. It is indeed a hard task, but we should never forget that peace is possible and that, in order to influence our surroundings positively, we must learn to develop inner peace within our minds. Shalom, Salam!

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Capitalism for Peace

Corrado Passera
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This University has adopted the slogan ***Science for peace***, to emphasise that science can, and must, fulfil an important role in the drive for and defence of peace.

Everyone can contribute to peace - the primary responsibility of politicians - and only if everyone pulls together will peace be preserved.

The *UN Conference on Environment and Development* proclaimed through the principles approved at Rio de Janeiro in 1992 that "peace, development and protection of the environment are interdependent and inalienable" (Principle 25).

Thus, *Science for peace*, *Culture for peace*, but also - my theme - "***Capitalism for peace***".

Until a few years ago, one could still discuss alternative economic systems opposed to capitalism; these have all collapsed and nowadays capitalism is universal, and can certainly be expected to remain so for many years to come.

We must therefore ask ourselves if and how capitalism can contribute to world peace, while offering prospects for growth that will benefit the whole of mankind.

Capitalism is merely a tool, not an end in itself. Its results - both short term and long term, both financial and social - depends on the way it is "used".

Since capitalism is a tool that operates in different ways according to the rules imposed on it by each different society, benefits have to be ascribed to capitalism itself, while deficiencies must be blamed upon those political systems that use the tool improperly, so preventing it from benefiting society as a whole.

In fact what we call "capitalism" is not a single standard. Capitalism changes over time and adapts to different cultures. Thus, there are several forms of capitalism; each form is different, but they all share a common *raison d'être*: development, innovation and continual transformation through the accumulation of wealth. Capitalism without growth is an unknown species.

The essence of capitalism is always the same; its forms and specific characteristics vary widely. We can essentially say that there exists a "crude" form of capitalism - a free-for-all system which resists all attempts at regulation, is motivated by profit exclusively, and regards human and environmental factors as mere resources to be exploited. And, that there are other forms of capitalism, that aim at economic growth along with social and political development, that try to make an intelligent use of resources and recognize the broader needs of humanity - such as solidarity and respect for the environment - while still creating surplus wealth to be invested in the citizen's present and future well-being.

Capitalism has both great merits and substantial flaws.

To date, it has proved the most efficient system for the production and distribution of goods and services, while creating a surplus for investment in security and welfare. Historically, capitalism has facilitated the greater part of human development - not only in terms of economic growth.

However, capitalism still suffers from a fundamental, historical flaw: it is uncapable of self-regulation. Unregulated, it readily lends itself to abuse of power by its strongest actors. Unrestrained, it leads to the depletion of natural resources and brings about ecological disaster. Without outside monitoring and intervention, it can cause serious social problems.

The form which capitalism takes is particularly important today, given its potential for making a significant - though indirect - contribution to the creation of lasting peace at a time when the world is confronted with crucial challenges.

* * *

The questions I mean to answer are:

1. **What can capitalism do to help create and preserve world peace?**
2. **Which form of capitalism is most in keeping with the cause of peace? Which are the distinguishing features of *capitalism for peace*?**
3. **What can individual nations do to promote *capitalism for peace*?**
4. **What can international organizations do to promote *capitalism for peace*?**

These are complex questions and - most important - there are no single answers to them, given the widely different conditions in different parts of the world. What follows is meant as a modest personal contribution from an executive businessman who was lead into a subject bigger than himself by friendship with professor Becker - but finds the subject very close to his own heart.

* * *

1. What Can Capitalism do to Help Create and Preserve World Peace?

Among the principal enemies of peace, we certainly find:

- poverty in general - with accompanying desperation, ignorance and violence - and the so called "new poverty", caused by certain extreme and untenable imbalances in economic growth.
- confrontations between peoples and nations, which come from historical conflicts that are often rooted also in divergent economic interests.

Capitalism has shown its effectiveness in:

- creating work and thus enhancing prosperity - not only economic prosperity - for an increasing number of people

- promoting integration among nations and governments through the development of mutual economic interests.

Thus, the answer to the first question is: yes, capitalism can contribute to peace through its effectiveness in fighting two of peace's key enemies. Effective incentives for cooperation and the rejection of violence are provided by trading relations between nations, joint ventures between companies, growing exchange of goods and services, bilateral and multilateral business links, and membership of international economic bodies, both regional and global.

Europe provides a good example. Countries and peoples that fought each other up to fifty years ago have developed a common economic interest. The European Common Market became a vehicle for dialogue and integration, and is now evolving into a stable political institution: the European Union. A change in vocabulary bears witness to our most important achievement: the word war is no longer used in solving problems between member states.

2. Which Form of Capitalism is most in Keeping with the Cause of Peace? Which are the Distinguishing Feature of Capitalism for Peace?

I have said that there are many forms of capitalism, all with the common aim of increasing wealth but with widely differing attitudes toward - and approaches in dealing with - the assets that belong to society as a whole.

I strongly believe that the form of capitalism best able to contribute to peace has three key characteristics: it is ***COMPETITIVE***, ***OPEN***, and ***RESPONSIBLE***.

- **COMPETITIVE CAPITALISM** creates growth through competition, rather than exploiting the market through the abuse of monopolistic or otherwise dominant positions.

Typically, this form of capitalism is centered upon private entreprise, which it values and fosters at all levels - at the level of small and medium-size business to begin with.

- **OPEN CAPITALISM** looks at the globalization of market a an opportunity, not as a process to resist or hinder. Therefore, it avoids setting up national or trading bloc barriers to the expansion of world trade.
- **RESPONSIBLE CAPITALISM** respects - indeed promotes - the growth of democracy and recognizes the primacy of politics. It values social cohesion , and accepts associated costs; it pursues policies for sustainable growth which respect the rights of the individual and the need to protect the environment.

"Sustainable" growth - rather than "growth" per se - has become an important issue in recent years. It is now widely accepted, that any proposal for growth and profit that affects society or nature should be considered in terms of cost and benefits both for the business involved and for the community and the environment, as the assets involved must be protected also for future generations.

Capitalism of this type - ***COMPETITIVE***, ***OPEN*** and ***REPONSIBLE*** - becomes a natural ally for those who work for peace - politicians, scientists, religious leaders, men of art and culture.

Such capitalism may be defined as ***CAPITALISM FOR PEACE*** because it fosters balanced growth within society; it does not translate the rules of business competition into extreme Darwinism among social classes or nations; it believes that economic growth must be matched by the enhancement of human dignity, the quality of life and democracy. Standards for protection of human rights and of the environment are now part of humanity's cultural heritage and are embodied in the United Nations Charter. Capitalistic economy must also conform to this framework.

It is often said that history is an excellent teacher, but its pupils are inattentive. Capitalistic production methods in 18th and 19th century Europe led to such evils as exploitation of child labor and indiscriminate use of natural resources, mainly in the colonies. Such outcomes are not necessary, and to expect them as unavoidable steps to entrance in the capitalistic system for recently joining countries - or for countries that are not yet there - would only mean that we refuse to learn from history.

3. What can Individual Nations do to Promote Capitalism for Peace?

Present situations across the world are so different that no one political and economical approach - nor any specific use of available levers - can be good for all.

It is clear, however, that individual governments can secure the most valuable benefits of capitalism through proper policies (job-creation, sustainable growth and respect for human dignity and the environment). Policies to achieve such goal must include:

- **INTRODUCING OR REINFORCING RULES** designed to promote and preserve competition, free the market from monopolies and dominant positions, and to accept the challenge of open global markets. Competition cannot survive - in local or international markets - without rules and the means of enforcing them.
- **INTRODUCING OR REVISING WELFARE SYSTEMS** as a safety net for the weakest members of society. It is both ethically and conceptually unacceptable to promote economic growth at the cost of doing away with the Welfare State. The Welfare State must be purged of waste, excesses and inequalities, and integrated with the accelerated development of the so-called “Third Sector” (non-governmental and voluntary bodies and in general non-profit organizations) - but

it must be defended as a hallmark of civilization and introduced in countries that still lack one.

- **INVESTING, INVESTING, INVESTING IN EDUCATION AND RESEARCH**. The future of any country - its potential role in the global marketplace - depends primarily on its KNOW HOW, on its brain power, on the skills of its citizens and enterprises. Most companies are progressively decreasing their commitment on basic research because of pressure on their short-term results deriving from global competition, shortsighted shareholders and short-term oriented stock options granted to top executives.

At the same time all developed countries tend to incur national deficits - a situation which leads to cost-cutting and austerity policies. However, there are areas of expenditure and government intervention which, far from being suitable targets for cutbacks, call for increased commitment. Education and research are clearly among these.

Today **the most important problem in our countries is unemployment.**

According to the UNO statistics quoted by Jeremy Rifkin in his book “The End of Work”, world unemployment today exceeds 800 million people, and technology - while fostering productivity - continues to erode the presence of labour in the production cycle. Where will new jobs come from?

They are and will be created by that same technology that on the one side destroys old jobs but on the other creates innumerable opportunities for new products and services and by companies culturally and organizationally equipped to take advantage of this new market place.

Recent history shows us that employment generated by large firms lags behind the burgeoning demand for work, while small and medium-sized businesses are able to create jobs, bring wealth and promote development not only in the so-called developed countries (most of the new jobs created in the last years in the United States are concentrated in new small and medium-sized companies) but also in countries that lack large quantities of raw materials and financial resources.

Indicative in this context is the case of my country, Italy. It has no raw materials, no great pool of capital, no large number of mega companies. The last fifty years have nonetheless seen remarkable growth in general prosperity, derived from a dense network of small firms. Nearly 5 million small and medium-sized businesses, with almost 13 million employees employ two-thirds of the national working population. Small and medium-sized industry is now the backbone of the Italian economic system, a system which has demonstrated its ability to respond very quickly to economic swings and market movements, while establishing productive relations with the local constituencies and transforming regions that were depressed a few decades ago into areas of wealth and social progress. This capability has enabled Italy to ride out the most troubled stages of various economic crises, while preserving and enhancing general living standards.

A top priority for any Government which wants to fight unemployment is to support the establishment and the development of new entreprises.

The development of a favourable climate for business enterprise is a complex issue, involving not only legislation but the attitude of individuals. This includes the will to solve problems through personal initiative and the extent individuals have access to the resources needed to establish an enterprise.

Government intervention is needed to create the conditions for the establishment and growth of new companies. Enterprise will not flourish without an effective financial/banking system, together with suitable infrastructures and appropriate tax and employment legislations.

Italy is currently at risk of forfeiting part of its business base precisely because of a systemic inability to maintain adequate standards of efficiency and overall country competitiveness.

Sometimes initially modest initiatives can have explosive results. Each country's financial and cultural situation is unique, but as a manager in the banking sector I have been particularly interested by an initiative aimed at developing entrepreneurial spirit in a very poor country. I refer to the achievements of Muhammad Yunus, professor of Economics at Chittagong University, Bangladesh, who founded the Grameen Bank in 1976. The bank's business is the granting of small loans (typically 50 to 100 dollars) to individuals, usually poor, to enable them to establish micro-enterprises. The bank is now large, efficient and thriving, with branches throughout Bangladesh and a customer base of 2 million very small business people (of whom - even more interestingly - 94% are women). Its loan recovery rate of 98% is the envy of many western commercial banks. Yunus, a winner of UNESCO's Simon Bolivar award, now also chairs the World Bank's Consultative Committee addressing small scale lending world wide, which plans to lend to some 100 million poor families by the end of 2005.

4. What can International Organisations do to Promote Capitalism for Peace?

Many successes in recent years have sprung from positive action by international organisations, which are increasingly concerned to promote sustainable growth.

International agencies are certainly to be credited with a primary role in the second "green revolution" aimed at improving the reliability of food supplies, in bringing new areas under cultivation, in major transport infrastructure programmes, in upgrading response to natural disasters, in increasing energy supply. These bodies have also brought together the world's experts, and direct stakeholders, in large international gatherings. Examples include the 1992 Rio Conference on Climate and Environment, and the very recent FAO summit on food (Rome) and WTO summit on the dismantling of barriers to trade (Singapore).

They clearly can and must do a great deal more, and require no input from me as to their plans and initiatives.

As regards the "capitalism we want" - the same thing as "capitalism for peace" - I believe that international organisations can contribute most by:

- **ELIMINATING** barriers to trade, by confronting two principal threats, namely:

1. new protectionism in the form of trading blocs, which threaten to replace national barriers with larger-scale confrontations at world level
2. social dumping, which generates damaging competition based on exploitation and the disregard of universally-recognised social, trade-union and political rights. The results are delusive: short-lived economic development but never lasting growth.

- **PROMOTING** world-wide programmes and projects drawing also on the economic, financial, technical and scientific resources hitherto allocated to defence. For example by:

1. stepping up scientific basic research projects in the areas of nutrition, health and energy
2. promoting development of the Information Society's new infrastructure also in the poorest nations, alongside growth of traditional infrastructures in those countries where these are still lacking. For the first time in history we have the possibility - through information and telecommunication new technologies - to put any country of the world on an equal opportunity basis. Internet is certainly not the global panacea, but certainly this kind of instruments can fill the information gap millions of students are still suffering from in many parts of the world.
3. providing incentives for environmental recovery through

proactive management of the ecological heritage and of biodiversity, creating joint responsibility with local populations for safeguarding natural resources in specific areas.

The list of possible examples is endless, but I would like to highlight an area where science and business could work together, to defuse a dramatic situation which threatens world peace as well as the environment: elimination of the stockpiles of nuclear and biological weapons accumulated over the last fifty years. In some countries such stockpiles are no longer under control. The risk to the human race is much greater than is generally believed (in terms of nuclear anarchy and of pollution). Scientific solutions for neutralising huge quantities of radioactive and bacteriological materials are not obvious nor are they entirely satisfactory or free of risk, while the opportunities for recycling are potentially huge.

* * *

I want to close with a message of realistic hope. During this century, capitalism has confronted - and overcome - a number of challenges which called its effectiveness - or very existence - into question.

Now and in the years to come, **if used responsibly**, capitalism will be capable of fulfilling - for an increasing number of people - the promise underlying its emergence and success: economic growth accompanied by an overall improvement in living standards. This will enable us to hand on to future generations a better world than we found.

However, I repeat: capitalism is only a tool; it can offer the prospect and hope of a more dignified life, but of itself it cannot guarantee achievement of such goal. Even the best economic conditions do not of themselves guarantee peace. There can be no peace without freedom and democracy; there can be no lasting peace obtained with oppression and exploitation.

Today, the fall of many ideals has generated mistrust, indifference, fanaticism and criminality. The leaders of the world are now faced with one fundamental task: offering mankind a dream that is realisable, with effort certainly, but one to which everyone can contribute.

Such dream can only be **PEACE**.

There's no magic formula for peace. Peace may never be absolute, and is certainly never secured once and for all. The best guarantee we can count upon lies in working for it - and defending it - together, men of politics, science, culture, religion, art and - as I tried to demonstrate - men of business who want to use capitalism to achieve the "right development for the whole human kind.

And Jerusalem is the best place to start.

Science for the Culture of Peace

Vladimir Kouzminov
Chief UNESCO Venice Office - Regional Office for Science and Technology for Europe

It was a timely initiative of UNESCO to launch in 1994 the *Culture of Peace Programme* which should help to create a new philosophy of human life based on principles of democracy, tolerance, respect of human rights and of cultural diversity. The founders of UNESCO, shortly after the Second World War, gave a mandate to the Organization, to construct the defences of peace for men and women which should be created upon the intellectual and moral solidarity and cooperation of humanity.

The current period of our transition from the Cold War period to a new political and socio-economic climate can be considered as a historical process of enormous importance for the transition from the culture of war to a culture of peace. All intellectual forces all over the world should be mobilized for and consequently involved in this tremendous effort.

Shortly mankind will enter into the 21st century and will start the third millennium of modern civilization. The outgoing century has been affected by the conditions of intensive socio-economic and political turbulence which from time to time reached dangerous destructive levels threatening human society and its further development.

Speaking about the phenomenon of turbulence as one of the major subjects of studies in the field of fluid mechanics and thermophysics, we should keep in mind its complexity based upon the so called “boundary conditions”. For example, in mechanics efforts are focused on the necessity of accelerating the passing of different kinds of flow of liquids and gases from the laminar regime to the turbulent one since only the turbulence brings an intensive and consequently effective exchange of heat and mass and makes the production and energy generating and consuming equipment efficient and productive. The “boundary conditions” being constantly elaborated by scientists and engineers should favour the turbulence in different engineering and technological devices but... until some certain limits after which the turbulence can achieve such levels where equipment can be even destroyed.

Some rules of turbulence can be applied to human society. The turbulence in our life brings exchanges in all areas of human activities. The socio-economic and political turbulence leads to the exchange of views, experiences in education, science, culture, industry, agriculture to the dialogue between cultures and logically to the cooperation aimed at the constant growth of the welfare of humanities.

Unfortunately from time to time as mentioned, this turbulence reaches such levels destruction created by the previous generations.

Why do these situations of aggressive and destructive turbulence appear in our world? I think it occurs because human society could not create very valid and effective boundary conditions in life which from one hand could stimulate the growth of turbulence but on the other hand could also diminish its level if the latter approaches the limits after which a conflict can start.

It is not a fault of humanity because for many centuries and even millenniums people have lived under the conditions when the culture of war prevailed. Now a new concept of life based on a completely different philosophy - on the “culture of peace” could lead to the creation of new humanistic values which could provide very favourable conditions or “boundary conditions” for a stable and lasting peace.

Even under the previous conditions of the culture of war, human society managed to elaborate some vitally important humanistic values such as tolerance, ethics, human rights etc. These values have already set up a solid ground for the culture of peace concept which should be further developed and put into practice. I strongly believe that the collective and creative thinking of humanity is capable to elaborate new values which will further contribute to and strengthen the culture of peace.

In this connection, the significance of inviting all intellectual forces of our society during this most important process of creative thinking should be emphasised.

The role of science in this process is of crucial importance and is based on the realization that the future of humanity depends critically on the continued vitality of science and its applications.

Having said this, I would like to mention the *Genoa Declaration on Science and Society* which was elaborated by representatives of some twenty national and international academies who met in Genoa, Italy in October 1995.

This Declaration states that *"...universality, freedom and critical thinking contribute basic elements in scientific process and form a common bond between all cultures. Accordingly, science can make a significant contribution to constructive dialogue between different cultures and thereby act as a powerful antidote to intolerance and ideological and racial barriers."*[1]

The Genoa Declaration makes evident that science is an essential and integral part of the culture of peace and also recognizes *"...the important and distinctive potential of science to contribute to a better future for mankind, in which the Culture of Peace prevails ..."*[2]

This document was presented by Prof. A. Ruberti, President of the Genoa Forum of UNESCO on Science and Society at the Plenary Session of the 28th General Conference of UNESCO in November 1995 and was greatly acknowledged by all delegations of UNESCO's member states.

The further promotion and circulation of the Declaration among national and international academies of sciences has enlarged the number of its supporters to some fifty academies and institutions.

The Genoa Declaration provisions were further developed during the Genoa Forum meeting held in Como, Italy in early December 1996 and resulted in the elaboration of the *"Como Declaration on Science, Society and Ethics"* which among other issues, specifically underlined the great role of science in establishing a stable and lasting peace based on the principles of the culture of peace.

The above actions which were organized by the UNESCO Venice Office in cooperation with some intellectual institutions of the European Region are not the only activities in the world. All of us should express our great appreciation of the Pugwash Conference efforts which for some forty years have contributed substantially to the scientifically justified dialogue between politicians aimed at the process of building peace throughout the world.

We should also recall with sincere gratitude the high level of scientific research done by an international group of experts headed by Acad. E. P. Velikov from the Russian Academy of Sciences which led to the elaboration of the concept of *"nuclear winter"* which contributed significantly to the decision making process related to nuclear disarmament.

A very positive imput on the latter was also made during the late 1970's - beginning 1980's by the *"International Movement of Medical Doctors Against Nuclear Dangers"*.

A number of scientific actions in the favour of peace is constantly growing and consequently a real contribution of science to the culture of peace has been substantially increased during the recent years.

I think that when we speak about science and culture of peace we should not divide exact, natural and social sciences.

Science is unique and each of its branches can contribute significantly to each other for producing new types of knowledge based on an interdisciplinary approach in scientific research.

Scientifically speaking the culture of peace is a true interdisciplinary phenomenon and therefore all ramifications of modern science and humanities should be involved in the elaboration of its principles.

At the same time we should not forget some important and immediate actions which science and particularly its exact and natural areas including engineering should do right away. In this connection, I would like to mention the process of military or defence conversion of which its success will depend to a great degree on science. Defence oriented research should be reconverted in order to provide its inputs to the meeting of basic human needs. Science should help people return even partially huge capital investments made by many countries for their defence. If science can produce in this particular field even modest visible results, the attitude of people to science (which at the present time is not very favourable) can be drastically changed in a positive direction.

Therefore, the UNESCO Venice Office and its partners such as the Landau Network Coordination Center, the Center of Scientific Culture “A. Volta”, the Moscow International Energy Club, the Hebrew University of Jerusalem and others are undertaking concrete actions towards the resolving of scientific and technological problems of military (defence) conversion.

I am pleased to inform the participants in this Symposium that in the near future, a new initiative - the UNESCO International School of Science for Peace will be launched in Como, Italy at the facilities of the “A. Volta” Center. After three years of cooperation with our partners in Como, which is by the way, an active member of the world wide movement of the Cities of Peace, we have managed to justify the necessity of this new mechanism of reinforcing science for the peace process.

I believe that during 1997 this School, which will be used for numerous activities as a meeting point of prominent experts for the reflection of different scientific and technological problems of military (defence) conversion, will be operational and extend the joint cooperative activities existing between UNESCO-ROSTE and its partners in Como.

This important activity will be obviously closely linked with the UNESCO "Science for Peace" School of Molecular Biology at the Hebrew University of Jerusalem which was set up two years ago upon Prof. Y. Becker's initiative and was strongly supported by my colleagues from UNESCO's Secretariat in Paris. This initiative has already produced very visible results and our objective is also to support the research, training and promotional activities of the School with a view of a wider involvement of scientists and university teachers from all Mediterranean countries in the School.

I am pleased, on behalf of my colleagues from UVO-ROSTE to congratulate Prof. Y. Becker and his collaborators from the Hebrew University of Jerusalem for their remarkable work accomplished in the name of peace.

Finally, I would like to express my idea that science will be one of the major components of the culture of peace and our plans will be focused on the better understanding of modalities and concrete instruments which science should use for achieving these noble goals.

[1] Genoa Forum of UNESCO on Science and Society, Genoa Declaration on Science - First Reflection Meeting: International Symposium on Science and Power. © UNESCO Venice Office - Cierre Edizioni - Verona, 1996.

[2] Ibid.

Building Bridges for Peace through Science

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As we approach the turn of the millenium, it is clear that science and technology play a crucial role in our society, being responsible for economic progress but also being absolutely necessary in protecting the environment, searching for alternative energy sources and improving our health, while being careful concerning bioethical considerations. Undoubtedly, science and technology may play a positive role in the conversion of the peace process into a common way of life, but extreme care must be taken to do it through a genuine collaboration, at a pace desirable to both partners.

We know that such a collaboration would be fruitful for both parties, but Israelis must be patient and let their partners “grow into it”. Under no circumstances should there be a feeling that we want to coerce the other side to collaborate more than they feel at any particular time that they are willing or able. On the other hand, we should make it clear that we are interested in such a genuine collaboration, we are not aloof and distant, and the only reason we are not more active is to avoid the impression that we are in any way pressing for a quicker pace than the other side is willing.

There is no doubt in my mind that this approach will be most fruitful, leading to undergraduate students, doctoral students and postdoctoral fellows coming to our institutions of higher learning, and our young scientists going for shorter or longer periods to Palestinian, Jordanian and Egyptian Universities. Research collaborations in some areas of agriculture, oceanography and human and veterinary medicine have already started with Egypt, and these will be extended to other disciplines and countries.

Education towards science is a necessary prerequisite for the world we live in. For this reason we started in Israel many years ago a most successful activity to improve teaching of science in schools. I am most familiar with the Department of Science Teaching at the Weizmann Institute of Science, which is part of the country-wide Amos de Shalit Center. Under one roof, teaching curricula are rewritten, textbooks are produced, toys of scientific interest are developed, teachers are taught how to teach, special journals for teachers are edited, and it is even possible to study for a doctoral degree in science teaching. I mention all this because all our textbooks are produced in Hebrew and in Arabic, and this is one area which could be a subject of early collaboration.

The areas in which the Department of Science Teaching at the Weizmann Institute of Science is active are mathematics, physics, chemistry, earth sciences, computer science, and the life sciences. In all these subject matter areas, the Department performs wide-scale research and development projects aimed at producing improved learning materials and implementing them throughout the Israeli education system. Work is based on an underlying philosophy that considers curriculum development and implementation, teacher development, research, and evaluation as a continuous long-term activity. Textbook writing, development of a wide variety of materials for non-frontal teaching, teacher education, cognitive research, and dissemination of information are some of the many activities that take place in an interactive manner. My only worry is always to avoid that an excess of information does not transform itself into a defeat of comprehension.

I stress the importance of building bridges for peace through science, because in times of war no progress makes any sense. It is only in times of peace - and as a result of peace - that humanity can get together, plan for common progress, and then the moral and ethical values become important and within their frame science can contribute for the benefit of all parties concerned. An early effort, of the initiative of UNESCO's Director General, Professor Federico Mayor, led to a meeting which took place in Granada, Spain, in December 1993. It was a meeting, called "Peace, the Day After," and it gathered Israeli, Palestinian, other Arabs, as well as some European and American intellectuals and artists, who were joined in their deliberations by Mr. Shimon Peres, our then Minister of Foreign Affairs, and by Chairman Yasser Arafat. I believe I was the only scientist there, and I mean the only representative of natural sciences. Undoubtedly, additional such meetings, with a stronger representation of scientists from the areas concerned, would be most constructive and fruitful.

Science as such knows no borders. I actually do not know of any human activity more international than science. Once the obstacles are removed, science flourishes across the borders for the benefit of all concerned, and this is the hope of all of us here, gathered at this Symposium on "Science for Peace."

The Landau Network: A Contribution to Science for Peace

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Some reflections

1. More than ever in a period of transition and soul-searching, today at the end of the bipolar system, it is necessary to refer to the compass of intangible principles and ideals. For UNESCO, this means going back to its "**Culture of Peace Programme**" - the shift from a culture of war and violence to a culture of peace.
2. The danger of war, violence, terrorism, famine, are today very high. All efforts must be made by individuals and organizations to work for peace. An active role in contributing to this work is played by scientists with their studies, discussions, meetings and proposals.
3. At Harvard, Professor Graham Allison, the head of a team from Harvard's Center for Science and International Affairs, produced a book-length report called "Avoiding Nuclear Anarchy" in which it is guessed that it is *only a matter of time before a terrorist detonates a nuclear bomb in America.*
4. At the end of the Twentieth Century, the world is faced by very serious problems connected to the future role of *nuclear weapons* and *nuclear deterrence*, the prevention of *nuclear proliferation*, the *disposal of nuclear, chemical and biological weapons*, the *conversion of military laboratories to civilian re-*

search and production units, the devastating effects of conventional arm tranfers to the theatres of local wars and the *widespread development of land mines* (now over 100 million land mines) with the killing of some 10,000 civilians every year.

Military activities have caused such formidable damage to the *environment* and to *human health* that their consequences will be felt for decades. Furthermore, damage has been spread throughout the ocean and atmosphere. The true extent of the environmental damage resulting from military activities during the Cold-War is massive and only now becomes apparent. There are many areas where *nuclear waste* from civilian and defence activities has been stored in disregard of internationally accepted standards established to prevent environmental damages. According to DOE, the United States will have to spend over (possibly well over) $ 230 billion during the coming decades to clean up contaminated sites.

5. *The "peace dividend" vanished years ago:* the cost of dismantling the surplus of warheads and nuclear bombs and the cleaning up the environmental mess is terribly expensive. For instance, how much the United States will be willing to spend on *nuclear security and accounting programs* in the former Soviet Union (FSU)? Imagine a program that could directly purchase FSU nuclear warheads from Russia for $1 million each. If there were 30,000 operative nuclear weapons to buy, this would cost the United States government *$ 30 billion*. Between 1992 and 1996, the U.S. Government has provided $ 10-20 million to improve the "material protection, control and accounting (MPCA)" in the Russian nuclear custodial system (the Nunn-Lugar gov-to-gov program).

   Another way to think about the value of *nuclear security and accounting* in the FSU is to calculate the economic loss that would result from a *single* nuclear attack against a US city. The present discounted value of lower Manhattan city is at least $ 2 trillion (~ 1/3 country's total annual GNP). Rationally, therefore the US government should be willing *to spend $ 2 billion per year* on nuclear security and accounting programs if these programs reduced the probability of a nuclear detonation in lower Manhattan city by only *one in a thousand per year.*

Political Issues

1. *What "Security" represents nowadays.*
   Traditionally during the Cold-War, security was almost exclusively defined by its "hard" component - concerning nuclear warheads, security was guaranteed by a huge number of bombs: about 20,000 and 40,000 tactical nuclear weapons were usable by US and FSU respectively in the mid-1980's. Today at the end of the Cold-War, the concept of security has changed drastically. It now includes a whole array of "soft" components and is immensurably broader and all-encompassing.
2. Security cannot be achieved without taking into account *economic, social, political and environmental issues.* One of the major cause of *instability* in the world today results from the simultaneus but opposing trends of *globalization and localization,* i.e. integration and fragmentation.
3. In matters of disarmament and arms regulations, considerable progress has been achieved on a global level in the 1990's towards the realistic goal of achieving the formula *"global = lower levels of armaments".*
   Some examples of successful global multilateral treatries are:
   - The **Treaty of the Non-proliferation on Nuclear Weapons (NPT),** signed for an indefinite time last May 1995;
   - The **Comprehensive Test Ban Treaty (TBT),** signed last September 1996.

4. In respect to the risk of nuclear weapons, the greatest change since the end of the Cold-War is "*the shift from direct nuclear confrontation between the superpowers to concerns with the proliferation of nuclear weapons and nuclear leakage*". Furthermore, the quoted NTP is *discriminatory* in its distinction between nuclear weapons States and non-nuclear ones..
5. *NATO doctrine of defence and Russia security*. Russia is now threatening to use its remaining nuclear forces to respond to threats to its security against possible attacks from its neighbors. The extention of the NATO umbrella to some eastern Countries is felt as a risk to its security by the Russian Federation.
6. *Nuclear weapons cannot be uninvented.* There remain doubts that the tradition of the non-use of nuclear weapons can be preserved indefinitely even if nuclear warheads are completely removed. In other words "nuclear weapons cannot be uninvented".
7. *Nuclear deterrence warrants a fundamental re-examination.* Currently, the spread of nuclear materials, equipment and technology and the political interests in the acquisitions of nuclear weapons by some non-nuclear States, may imply a *decoupling of deterrence and nuclear weapons.*

The "Core Mission": some recommendations

1. Under all circumstances the "core mission", that is deterrence of the use or threat of nuclear weapons, requires perhaps the number of weapons *going to zero.* However, the nuclear weapons cannot be uninvented. *So, what is needed are further alerting measures:* it is necessary to develop more rigorous technical verification systems and monitoring/controlling of illegal nuclear traffics.
2. All approaches require some strengthening of international

institutions concerning nuclear weapons, but *not* only nuclear weapons! At a minimum the verification of compliance with the provision for non-possession of nuclear weapons must become *the responsability of an international agency*, e.g. IAEA. As a maximum, *an entirely new international institution might become the sole owner of all nuclear (biological ?) materials and nuclear (biological ?) weapons.*

3. "Nuclear non-proliferation", as well as the "environmental issues" associated with fifty years of Cold-War, are ultimately a *political-economical problem!*
   The allies of 1942 needed a "Manhattan Project" (cost $ 2.6 billion calculated in 1996 dollars) to start the nuclear age. *Today we need an "International Manhattan project" to bring the nuclear age and the scum of The Cold-War to an end.*
   This idea is a sort of revised "Global Infrastructure Project", proposed in 1977 by Masaki Nakajima, president of the Board of Mitsubishi Research Institute. The basic concept of this global project was the setting of a "global fund" directed to face macro-projects affecting the long-range peaceful goals of humanity.

The Landau Network Contribution

The *Landau Network Coordination Centre* (LNCC), a scientific education cooperative structure established by the *Centre of Scientific Culture "A. Volta"* located at Como, Italy, and by the *Italian Ministry of Foreign Affairs,* is devoted to enhancing any form of cultural and scientific cooperation between scientific institutions and communities on a worldwide basis. In particular a special emphasis is given to:

1. The organization of international conferences and working groups on subjects that are relevant to the "Basic Sciences" in theoretical and applied physics, chemistry, biology and

genetics, as well as to world affairs, global welfare and initiatives to encourage peaceful coexistence.
2. The assignment in Italy of temporary fellowships to scientists, professors and technicians of the former Soviet Union.
3. Major issues of LNCC for conferences and working groups sessions are:
   a) Conversion of military science and technology which is channeled by the needs that are not covered by the existing markets, but that are connected with the long-term goals for society.
   b) Environmental and human health issues. Strategy, policy, management and control of wastes from the areas of intensive military nuclear former activities and nuclear power plants.
   c) Technical and political aspects of nuclear / biological nonproliferation; control and monitoring of illegal nuclear / biological traffics. Construction of a mathematical multiparameter model of a monitoring and control system.
   d) The use of military satellites to monitor bio-masses and more general the use of biological war's technologies to improve the demand of nutrition in the developing Third World.

B. SCIENCE FOR PEACE
IN THE BIOLOGICAL SCIENCES

The Contribution of Biotechnology to Peace

Ephraim Katzalski Katzir, Weizmann Institute, Rehovot, Israel

Mr Chairman, my colleagues:

It's a pleasure and an honour for me to participate in this symposium on "Science for Peace". Here in Jerusalem, peace is something we have been striving to attain for hundreds, even thousands of years. It was also here, at the Hebrew University of Jerusalem, that the foundations were laid for modern science in Israel. And so I feel that Jerusalem was a most appropriate choice of venue for this important conference.

Going back to the beginnings of Jewish history, peace is often mentioned in the Bible, where it has a range of meanings. *Shalom* means safety; it also means physical welfare, and friendship. In Psalm 34 we read: 'Is there anyone among you who desires life, longevity and well-being? Seek peace, pursue integrity, and *shalom*.'

In the *Talmud*, which was compiled by rabbinical scholars in the 4th century, justice and peace are the most exalted of ideals. Rabbi Shimon ben Gamliel states in one of the tracts of the *Talmud*: "By three things the world is preserved - by truth, by judgement, and by peace." The role of the scholar, according to the *Talmud*, is to disseminate peace in the world, to bring about the rule of peace so that the messianic age will come.

When it comes to prayer, there is not a blessing or prayer in the liturgy - the *Amidah*, the *Kaddish*, the priestly blessing, Grace after Meals - that does not conclude with the prayer for peace. The Modern Reform Union prayer book contains the following prayer: "Grant us peace, thy most precious gift, O thou eternal source of peace, and enable Israel to be its messenger unto the peoples of the earth. Bless our country, that it may ever be a stronghold of peace and its advocate in the council of nations."

Shalom is one of the names of God. *Shalom* is also the standard greeting among Jews, both upon meeting and on saying farewell, and so it is not only constantly in our hearts but also often on our lips.

As I have already mentioned, it was here in Jerusalem that the foundations of modern Israeli science were established at the beginning of the 20th century. The founding fathers of the Hebrew University believed that Mount Scopus would become a great centre in which both the sciences and the humanities would flourish. Here we would widen and deepen our understanding of life, and renew our ancient ethical and moral values by applying them to the modern world.

The Technion, our foremost school of engineering, was opened in Haifa at the same time as the Hebrew University was established in Jerusalem. Both were preceded by an agricultural station that was set up to provide instruction and guidance for the pioneer farmers. Today we also have Tel-Aviv University, Bar-Ilan University in Ramat Gan, the Ben-Gurion University of the Negev in Beer Sheba and the Weizmann Institute of Science in Rehovot. Indeed, from the very beginning the effort to build a new Jewish state went hand in hand with the determination of our leaders to create centres of excellence and advanced learning. Chaim Weizmann, himself a distinguished chemist and biotechnologist, and the first President of the State of Israel, often stressed the central importance of science in the life of the new state. In his words: "Science will bring to this land both peace and a renewal of its youth, creating here the springs of a new spiritual and material life."

As a molecular biologist I derive much satisfaction from the remarkable way in which the life sciences have flourished in Israel. More than half of our academic teaching staff are in the life sciences - agriculture, health care, genetics, and the various branches of biochemistry, biophysics and biotechnology. Biotechnology in particular is shooting ahead very rapidly, and its development all over the world is truly remarkable. So I am happy to have this opportunity to share with you my thoughts about the ways in which the life sciences, and in particular genetics and biotechnology, may contribute to peace, not only in this volatile region of the Middle East, but wherever there are people in the world.

Obligation of Scientists to Promote Peace

Scientists have the ability and, I believe, an obligation to contribute to peace, in both direct and indirect ways. For peace means not only an end to the state of war, but also a condition in which the highest value is placed on human life and freedom, on human rights and dignity. It seems to me that our respect for these fundamental human values should increase as we come to understand more about the complexity of living organisms and the superior brain power of *Homo sapiens*. I have always been fascinated by the uniqueness of the human brain. Humans are the only creatures on earth that possess, in addition to the genetic apparatus for physical heredity as in other living organisms, an organ which enables information to be accumulated and stored, modified and transferred from generation to generation, not through the genes but through education and teaching, through books, radio, television, the internet - in short, through bioinformatics, via the exercise of the mind and brain. Thus, in addition to our complex anatomical and physiological structure, we humans are blessed with what I like to call an ‘artificial gene’, which allows us to understand and master the wonders of our world, and of life, and of the human brain itself, and to pass on this acquired understanding to our children and grandchildren. We can also modify the acquired information, which can then, like mutations in biological heredity, be transferred to future generations. So let us cherish life, and do all we can to attain peace in the full Biblical sense of the word - friendship among peoples, and safety and well-being for all humankind.

Coping with the Coming Population Explosion

In trying to anticipate the global events and problems that lie ahead, one of the most important factors to take into account is the projected population growth. The world population today is approximately 6 billion. Within 10 to 20 years this number is expected to double. There are three hypothetical scenarios for population growth in the coming century: 1) If, early in the next century, fertility levels decline from the present global average of 3.3 children per woman to 1.7, the world population will peak at 7.8 billion in the middle of the 21st century and decline slowly thereafter. 2) If, within 60 years, fertility drops to an average of 2.1 children per woman, the population will increase to at least 11 billion before leveling off at the end of the 21st century. 3) If fertility declines to no lower than 2.5 children per woman, the global population will grow to 19 billion by the year 2100 and reach 28 billion by 2150.

All three scenarios point to one inescapable conclusion: the population on our planet will continue to increase at a formidable rate. The corollary is that peace on earth will be out of the question unless there is enough food to go round and adequate health care on a global scale. Meeting these needs will be the prime challenge of the world community in general, and of scientists in particular. This is where biotechnology comes in, as the scientific discipline that offers the best hope of contributing materially to solving the problems of providing food and health care for future populations.

Biotechnology: Its Meaning and Potential Impact

What is biotechnology, and why is it so important? Biotechnology is the harnessing of those biological processes that are capable of yielding products of use in industry, agriculture or medicine. It is not a new discipline, and in fact has been known for hundreds of years. Some classical examples of biotechnology are the use of microorganisms (yeast, bacteria) in fermentation, the utilization of plants to provide compounds of medical importance, and the exploitation of animals for their milk or wool.

Modern biotechnology is based on a vast amount of new information about the composition of living cells, the properties of high-molecular-weight cellular components (nucleic acids and proteins), the structure and function of genes, and the nature of complex biochemical processes. Such knowledge will enable scientists to exploit both conventional and new food sources with maximum efficiency. It will also lead to the development of new drugs and novel therapeutic techniques, which will eventually become feasible options for the less affluent populations as well.

Before listing some of the achievements of modern biotechnology, let me try to give some idea of its potential impact by summarizing a recent report of the European Commission for Biotechnology. In listing the expected benefits, the Commission predicted that biotechnology would play a major role in streamlining modern agriculture, in scaling up processes and methodologies of production, in developing advanced technologies for nutritious foods, in promoting crop growth, forestry and rural development, and in multiplying fish production. It was noted that biotechnology could be expected to contribute to marked improvements in biomedicine and health care, with the production of new drugs and vaccines, the development of novel treatments for neurological, mental, immunological, cardiovascular and viral diseases, broadening of our understanding of brain function at the molecular and cellular levels, and providing new insights into the mechanisms of pain regulation and relief. Furthermore, biotechnological applications of modern genetics and molecular biology were considered likely to yield new strategies for dealing with cancer, as well as AIDS, tuberculosis, and other infectious diseases.

Biotechnology and the Information Explosion

Elucidation of the detailed structure of genes and proteins has led to a huge proliferation of research in the various branches of modern biology. The research literature in the life sciences is increasing by roughly 250,000 articles a year. Nucleotide sequences, composed of nucleotides that serve as the building blocks of nucleic acids, are being added to the data bases at a rate of more than 210 million base pairs per year.

The wealth of accumulated information on the structure of genes, nucleic acids and proteins has led to the development of a new branch of biology, bioinformatics. This scientific discipline encompasses all aspects of biological information acquisition, processing, storage, distribution, analysis and intepretation. Bioinformatics employs the combined tools and techniques of mathematics, computer science and biology, with the aim of understanding the biological significance of a vast amount of data.

Molecular biologists who work with homogenized tissues and materials purified from living organisms refer to bioinformatics, somewhat disdainfully, as the ‘dry’ biology, the biology of computers and informatics. Nevertheless, the most remarkable achievements of recent years are clearly the result of a combined application of the ‘wet’ and the ‘dry’ biological approaches.

An indication of the increasing importance of biotechnology is given by the fact that biotechnology is big business these days. Hoecht Schering Agr Evo (Berlin) recently paid $ 730 million to acquire PGS International (Amsterdam), a bioagricultural company specializing in plant genetics. This record-breaking transaction will no doubt set a precedent for the swallowing up of other biotechnology companies by major corporations.

Marine Biotechnology

The greater part of the earth is covered by the oceans, which contain vast food resources that are still largely untapped. Marine biotechnology is therefore becoming an increasingly important branch of activities which, if properly developed, promise to yield virtually unlimited amounts of food. In 1991, world-wide marine aquaculture produced 14 million metric tons of fish, with a market value of approximately $28 billion. By the year 2025, the projected global demand will be increased by sevenfold. The increasing demand will come at a time when the world's fisheries, already overexploited, are becoming commercially extinct. Accordingly, scaling up of fish and other marine production will depend on the successful application of modern biotechnological techniques. These will incorporate molecular genetics, production and use of hormones, and improved captive management for the programmed reproduction of more numerous and more nutritious species.

Using the biotechnologies now available, fish and other sea creatures can be raised in huge seawater ponds or in containers kept in the sea. Marine fish, unlike most other edible organisms, have the great advantage of adaptation to a salt water environment, obviating the need for expensive desalination.

In Israel, as in many other industrialized countries, there is a growing tendency to look to the sea as a food source. For large-scale food production, the old-fashioned methods of fishing by going out to sea in fishing boats are no longer satisfactory, because of marine pollution and competition with fishermen from neighbouring regions. Instead, much attention is being directed to mariculture, a relatively new branch of farming in this region. In Egypt, for example, where 2000 km of coastline are available for fish farming, the annual production of fish is about 60,000 metric tons, which is only about 20 percent of the potentially available yield. Fish consumption per capita has reached 5 kg per year, of which salt-water fish accounts for about 80 percent.

In Israel, as in Jordan, aquaculture and mariculture are still relatively small-scale industries, with new techniques still being tried out. Annual production of fish from saltwater ponds and sea containers is about 1000 metric tons, and the aim is to increase this to 10,000 metric tons by the year 2010. In one interesting biotechnological application, fish are raised in a closed system of seawater ponds, and their secreted nutrients are fed to shellfish and algae, which convert them into edible and marketable products. This integrated system results in high yields of fish, algae and shellfish, without wastage of nutrients or water.

Modern techniques of marine biotechnology should yield excellent results in desert regions that border on the sea. In these localities the seawater quality is usually high, the strong sunlight facilitates intensive photosynthesis, and the relatively high temperatures encourage rapid growth of fish.

Transgenic Plants

It is now technically possible to transfer genes, and hence heritable characteristics, from one living organism to another. This has been done in bacteria, eukaryotes, and even plants and animals. Let me give just a few examples of promising transgenic plants: Cotton resistant to Lepidoptera and Coleoptera pests has been prepared by Monsanto; corn resistant to Lepidoptera pests has been prepared by Monsanto and other American companies; corn exhibiting resistance to fungal pathogens and tolerance to the herbicide phosphino-thricine has been prepared by Holdens; a transgenic tomato with enhanced soluble solid content has been prepared in Florida and is currently being marketed in American supermarkets; several laboratories and companies have prepared soybeans with increased lysine levels and phosphino-thricine tolerance.

The first genetically engineered virus-resistant papaya, developed at Cornell University and the University of Hawaii, was recently cleared for commercial production. Its resistance to the widespread papaya ringspot virus, transmitted by aphids, promises a marked increase in papaya crops.

In the Far East, where rice is the staple food of nearly a billion people, considerable research is devoted to improving crop yields. Over the past 25 years scientists at the Institute for Rice Research and Development in the Philippines have developed different rice varieties, including one with almost twice the yield of the traditional crop. The new pesticide-resistant species contains more seeds per plant and can be harvested as many as three times a year. Just as important, it also has a stem that is sturdy enough to support the increased plant weight. Further advances in genetic engineering can be expected to result in the production of new transgenic strains with even higher yields.

In the future, biotechnology will undoubtedly contribute to a major increase in global food supplies through the transgenic production of crops resistant to viruses and other pests, as well as to other natural hazards such as frost and ice. In addition, genetic engineering techniques have already been exploited in aquaculture, where the transgenic insertion of growth factors and anti-freeze proteins into fish has dramatically increased their growth rates and cold tolerance.

Transgenic Livestock

Transgenic techniques have also been applied to higher animals, such as cows, pigs, goats and sheep. What is remarkable here is that these animals can be genetically modified to produce new species that not only exhibit improved agricultural qualities, such as increased milk production, but also manufacture relatively large amounts of rare biologically active proteins of therapeutic importance for human diseases. We now have transgenic cows that can produce human insulin or growth hormone in their milk. Transgenic sows and goats are producing significant amounts of human protein C and anti-thrombotic protein in their milk, whereas in human blood the native proteins are present only in trace amounts. The Genzyme Transgenic Corporation is involved in this transgenic production of anti-thrombin III factor, which will be used to reduce bleeding in coronary artery bypass surgery.

The notion of obtaining essentially unlimited amounts of scarce human blood proteins at reasonable cost would have seemed pure fantasy just a short time ago. Transgenic experiments are now under way to develop new animal species capable of producing plasma proteins, monoclonal antibodies, antibodies against cancer and other proteins. The results of this work are likely to culminate in an entirely new branch of the pharmaceutical industry. It will be possible to create transgenic livestock "bioreactors" merely by breeding more animals, resulting in the production of many novel biologically acquired drugs at prices within reach of health budgets in both developed and developing countries.

Genetic Mapping and Gene Therapy

Finally, a few words about the human genome project. This major human project, which is equivalent in scale and cost to putting a man on the moon, embodies some of the most spectacular recent achievements of biotechnological research. Launched at the National Institutes of Health in Bethesda, Maryland, about 15 years ago, the aim is to identify the structure and function of the 100,000 or so genes in the human body. This will make it possible to produce, within the next 15 to 20 years, a detailed genome map of all the sequences and meanings of the four-letter genetic code. Such a map will not only shed light on many hereditary characteristics but will also enable us to characterize and isolate the genes responsible for the approximately 4000 gene-transmitted hereditary diseases, including haemophilia, muscular dystrophy, Gaucher's disease, colon cancer, Huntingdon's disease, cystic fibrosis, sickle-cell anaemia, retinoblastoma, Alzheimer's disease, Tay-Sachs disease, and breast cancer. This ambitious project is expected to revolutionize the diagnosis and treatment of such diseases.

The role of genes in the etiology and pathogenesis of certain diseases has already been elucidated. A practical outcome of such knowledge may be illustrated by the experience of Renee and David Abshire, whose small daughter died of Tay-Sachs disease in 1989. The parents, both healthy carriers, determined never to have another child unless they could be certain that it would be free of the disease. They subsequently underwent an *in vitro* fertilization procedure, and seven ova were fertilized in the test tube. After three days, when the fertilized eggs had reached the eight-cell stage, one cell was removed from each embryo and its DNA analyzed for the Tay-Sachs gene. Three were free of the gene and were implanted in the mother's uterus. One survived, and a healthy little girl was born.

Rigorous genetic analysis can reveal the presence of mutant genes that may code for dysfunctional proteins, giving rise to faulty biochemical processes. Study of the mutant genes and their abnormal proteins can be expected to open up new vistas for the development of novel drugs for the treatment of hereditary diseases. Not surprisingly, the large pharmaceutical companies are showing great interest in the human genome project.

Direct benefits of this project can also be expected in gene therapy, an aspect of health care still in its infancy. In this new discipline attempts are made to repair dysfunctional human cells by blocking the activity of faulty genes and replacing them with normal genes that will produce the normal native proteins. This kind of manipulation will herald a breakthrough to an entirely new order of therapeutic techniques in modern medicine.

A dramatic example of successful gene therapy is given by the treatment of two little girls in Ohio. In both children the white blood cells lacked the gene coding for an enzyme, adenine desaminase, causing their immune systems to function at dangerously low levels. White cells were withdrawn from their blood, normal genes were inserted into them, and the cells were returned to their bloodstreams. It was hoped that the inserted gene would stimulate the blood cells to start producing enough natural enzyme to boost the immune system, and this is exactly what happened, transforming the two little invalids into active, healthy children. However, since white blood cells have a limited survival period, a complete cure would require the gene to be introduced into the longlasting stem cells that reside in the bone marrow. This is precisely what their doctors are now attempting to do.

The above few examples may serve to illustrate the profound impact, both actual and potential, of modern science, especially genetics and biotechnology, on standards of living and well-being, and thus on the very structure of societies. But we should bear in mind that while the new knowledge opens new doors, it does not compel us to enter. What we do with the fruits of science and technology will inevitably depend on what we value. We now have ways to do things that were formerly not possible. We have far more choices to make, and these choices are not only possible but unavoidable. Physicians today can prolong life in a variety of situations. Should they, however, prolong life under any circumstances? Should countries continue to stockpile atomic weapons? Who is to be allowed access to the vast quantities of computerized information on the personal histories of individuals and families, the standing of companies, the socioeconomic situation of nation and countries? These are tough moral questions, and they raise legal and social issues that will have to be addressed and resolved, in order to ensure that the powerful new tools and techniques are not abused. The achievement of peace, and the future of humankind itself, will depend on the ability of the nations of the world to come to terms with these issues.

International Cooperation in Scientific Research and Development

If science is truly to contribute to peace, it is not enough for scientists and entrepreneurs to involve themselves in advanced research and development, however impressive the results. In addition, their governments must take active steps to ensure that other countries and nations, particularly the less developed ones, can also benefit from the work. This is especially important for overpopulated areas with rapidly increasing food and health care needs. As I have already indicated, a prerequisite for peace is enough food to go round and adequate medical attention. In this connection, let me tell you something about the activities of *Mashav*, the International Development Cooperation Programme run by the government of Israel. *Mashav* conducts a wide range of operations in developing countries with the object of promoting their agriculture, health care and general socioeconomic welfare. Its programmes are designed to develop human resources and professional skills by combining theory with a practical approach aimed at improving production and applying appropriate solutions to the unique needs of different countries and cultures.

Since it was first established nearly 40 years ago, *Mashav* has conducted a variety of courses at its headquarters in Rehovot to train young professionals from many parts of the developing world. The courses equip them with advanced knowledge and practical skills, which they can then apply when they return home.

Mashav also sends consultants on a short-term or a long-term basis to work with their local counterparts on programme implementation in various countries in Africa, Asia and Oceana, Latin America and the Caribbean, Central and Eastern Europe, the Middle East and North Africa. Some examples: a model training farm was recently set up at Yongledian in China, near Beijing, where local farmers can learn about the most up-to-date techniques of greenhouse or field cultivation of vegetables, flowers and fruit trees. This outstanding model farm is visited each year by thousands of Chinese as well as by people from neighbouring countries. In Kazakhstan, at the Almaty experimental and demonstration farm, which is managed in cooperation with the local agricultural university, farmers learn how to apply technologies for raising dairy cattle and milk production. The Kibwezi experimental station in Kenya, one of the longest-running projects of *Mashav*, is located in a semi-arid area, and demonstrates advanced agricultural techniques of vegetable cultivation and other activities. It has become a centre for agricultural training in Kenya, providing in-service courses for the local population as well as for people from neighbouring countries. The Ha-Tai project in Vietnam, close to Hanoi, operates in collaboration with the local agricultural college and demonstrates advanced technologies for greenhouse and field cultivation of vegetables. This is the first time that modern farming techniques are being introduced into Vietnam.

The above brief account of a small sample of projects may serve to illustrate the method adopted by Israel for the sharing of experience and know-how in agrobiotechnology and health care with interested countries. Other highly developed countries engage in similar activities. Such projects will undoubtedly result in improved crops and better health care, thus raising local standards of living and the quality of life. Joint projects of this type will also help to raise a new generation of local biotechnologists, capable of using modern techniques of genetic engineering and molecular biology in the interests of their country"s continued advancement.

I feel strongly that experts in the highly developed countries should make a special effort to train young scientists by initiating appropriate courses, training suitable candidates in their own laboratories, and actively promoting the existence of an adequate local infrastructure for research and development.

Concluding Remarks

Recent developments in recombinant DNA technology and in genetic engineering have, I feel, allowed us to enter the Kitchen of the Almighty. Here our glass pots and pans bubble away as we introduce or remove genetic ingredients according to our own recipes, and produce new living organisms capable of transmitting the new genetic characteristics to their offspring and to all future generations. In designing and producing new species of living organisms we have become, if not prime movers, at least participants and partners in the creative process. Let us have the wisdom and the humility to use our knowledge for the good of humankind. Let us work to ensure that there will be food and shelter, health and education for all people of all nations, and in this way let us promote peace between all the peoples on earth.

I am by nature an optimist, and my feeling is that the human race will ultimately take care of itself. I believe, moreover, that when sophisticated technology is put at the disposal of people deeply committed to a code of valuing human life, then a better future is to be anticipated. The marriage of scientific thought and moral responsibility is wonderfully expressed by Telhard de Chardin, a mid-20th century French theologian-philosopher, in his image of man: “Man is not the centre of the universe, as was naively believed in the past, but something much more beautiful – man is the ascending arrow of the great biological synthesis of life, man is the best born, the keenest, the most complex, the most subtle of the successive layers of life. Into his hand are entrusted the future of the coming generations of all living creatures, and even of our planet itself.”

The choice before us is expressed in the stirring words of Deuteronomy: “I have set before you life and death, the blessing and the curse; therefore choose life, that both thou and thy seed may live.”

Science can provide some of the essential tools for the attainment of peace, in its broadest sense. Let us use it wisely, to choose life and to strive for peace.

The American Society for Microbiology Prevention of Biological Warfare

Kenneth I. Berns
President, American Society for Microbiology, New York, USA

Good morning! I speak here this morning as a representative of the American Society for Microbiology of which I have the honor to be President this year. The ASM has more than 43,000 members, about 25% of whom are international members from outside the United States. It is intended to be an inclusive organization for all who work or have an interest in microbiology. The Society has fundamental involvement not only in the promotion of scientific knowledge among its members, but also in the impact of microbiology on the public and in those public affairs which affect or deal with microbiology.

Foremost among the issues affecting the use of microbiology for peace is the problem of biological warfare, in which microorganisms are the major weapons. Although the membership of the ASM has been against the very notion of biological warfare, the subject has long been a contentious one in several ways. While only a very few would argue that biological warfare might be a humane form of war, a more problematic question has been whether microbiologists should engage in national defense efforts involving research in biological weapons. A particularly thorny question has been whether research for defense against biological weapons can ever be truly separated from research that affects offensive capability in this area. A more philosophical issue has been whether the Society can appropriately tell its members what types of research not to do, so long as that research is legal; i.e., can the ASM provide real moral direction to its membership.

Members of the ASM have a considerable history of bringing scientific and technical knowledge to the issue of biological weapons control and being available to serve in advisory roles to the government. ASM's involvement with the biological weapons issue began in the 1940's, when microbiologists served as advisors to the government's Biological Defense Research Program and participated in the Biological Warfare Committee of the U.S. National Academy of Sciences. In 1970, a controversy arising from the ASM's involvement with the issue abated when the ASM Council approved a statement concerning non secrecy and free movement in research. Simultaneously, the society affirmed support for President Richard M. Nixon's action to end the U.S.'s offensive biological weapons program. The Society's Code of Ethics, published in 1985, contains two relevant sections that seek to discourage ASM members from participating in biological weapons development. The first is "Microbiologists will discourage any use of microbiology contrary to the welfare of human kind." Second "Microbiologists are expected to communicate knowledge obtained in their research through discussions with their peers and through publications in the scientific literature." Clearly, however, the second is equally pertinent to all research done in the burgeoning area of biotechnology. The ASM has sponsored a series of round tables and other activities through its Public and Scientific Affairs Board (PSAB). About four years ago the ASM renewed its commitment to a resolution it passed in the 1970's to support the Biological Weapons Convention of 1972 and to work to prohibit the possession, development and use of biological and toxin weapons.

ASM has beome increasingly active in offering its expertise and good offices in several areas to protect against the use of biological weapons. An early example of this occurred shortly after the Gulf War. The United States Department of Commerce was concerned about reports of shipments of anthrax bacillus to laboratories in Iraq from the American Type Culture Collection.

These shipments had been in conformity with U.S. law and had been approved explicitly by the Department of Commerce. However, the unfavorable publicity generated by the shipments, because of concern about the potential use of biological warfare agents by Iraq, led the Commerce Department to consider establishing a list of equipment used in biological research which would be prohibited from shipment to countries which had not signed the Biological Weapons Convention or were not in conformity with the Convention. The ASM was asked by the Commerce Department for comments concerning the items proposed for inclusion on the list. Consideration by ASM members of the proposed items to be restricted led to several concerns with this approach. Many of the items, such as laminar flow hoods, were equipment that could be used in medical laboratories and were likely to be able to be obtained from many sources outside the U.S. Our advice to the Commerce Department was that the list was unlikely to serve any useful purpose in terms of limiting research on biological weapons , but would open the U.S. to criticism for inhibiting medical care and research in some developing countries.

Although the United States had signed the Biological Weapons Convention in 1972, in 1989 it was not against the law to engage in biological warfare. In 1989 the Public and Scientific Affairs Board of the ASM worked with key members of Congress to perfect language in legislation that would prevent the use of biological weapons as agreed to by the U.S. in the Convention. Although the ASM vigorously endorsed the intent of the legislation , it raised concern about specific language proposed for inclusion in the Senate bill that would have shifted the burden of proving innocence to accused scientists and that could have been used to restrict peaceful research. In other words, anyone could have accused a scientist of working with either a pathogen to be used in biological warfare or with a vector. Almost any microbe could fit this description. The consequence of such an accusation would have been seizure of all the scientist's materials; to get the materials returned, the scientist would have had to prove in court that he was not engaged in biological warfare. The ASM submitted written statements to Congress outlining its concerns. Subsequently an amended bill was introduced to the Senate; this bill did not contain the language which would have placed the burden of proof on the scientists, rather, the accusers had to prove that the scientist was engaged in illegal behavior; i.e., we were back to the notion of innocent until proven guilty rather than the reverse. The amended bill specfically stated that "nothing in this Act is intended to restrain peaceful scientific research or development." The congressional report included language stating that Congress was aware that many scientists conduct peaceful research with potentially dangerous agents and toxins and the bill would not interfere with such activities. On May 22, 1990 President Bush signed into law the "Biological Weapons Anti-Terrorism Act of 1989." The final legislation acknowledged the contribution of the ASM.

In 1991 the Public and Scientific Affairs Board advised Senator Nunn, the Chairman of the Senate Armed Services Committee concerning agents that potentially could be used by terrorist groups. The Board forwarded a letter to Senator Nunn expressing concern that a provision of the FY 1992 Department of Defense Authorization Bill restricted the Biological Defense Research Program of the Department of Defense to doing research directed only at "validated warfare agents." The word "validated" was narrowly defined by the Department of Defense as an agent assessed by the intelligence community as being developed or produced as a weapon. The Board considered this to be a naive effort to either save money or to restrict biological weapons research. The letter to Senator Nunn pointed out that the language did not permit the Biological Defense Program to prepare defensive measures against emerging or potential agents that might be used by unfriendly nations or terrorist groups. The restriction could have inhibited the Medical Command from conducting research on organisms that might be indigenous to areas where our troops could be sent. The Armed Services Committee of the Senate adopted a provision that would permit the Medical Command to continue research and development on potential agents.

In 1993 the ASM Council (the governing body) adopted a set of scientific principles to guide the verification of the Biological Warfare Convention. The ASM stressed that global surveillance of emerging diseases will contribute to early warnings of biological weapons usage.

In late 1994 the Public and Scientific Affairs Board convened a task force of expert scientists to assist the U.S. government in developing scientifically sound approaches to biological arms control. The task force reflects the breadth of expertise on biological weapons found within the ASM. The task force has reviewed the Royal Society's report "Scientific Aspects of Control of Biological Weapons" from the viewpoint of U.S. security, research and industry interests and is considering issues relevant to effective monitoring to detect as early as possible any employment of biological weapons. In regard to possible usage of biological weapons, the most likely scenario is that they will first be employed by terrorists. In view of this threat, a critical area that has not received sufficient attention on the international level is how to deter terrorist groups from acquiring and using biological weapons.

In early 1996, the ASM testified before Congress on the transport of human pathogens and assisted the Centers for Disease Control in establishing new regulatory requirements for transferring and receiving select agents which have the potential to cause widespread harm. The new regulations are intended to minimize the risk of illicit access to infectious agents. On April 24 President Clinton signed into law Anti-Terrorism legislation (PL 104-132) which expands federal power to prosecute and punish certain crimes related to terrorism. A bipartisan amendment was included in the new law making it illegal to develop, acquire or attempt to purchase biological agents with the intent to kill or injure or use them as a weapon. The provision on biological agents amends the 1989 Biological Weapons Anti-Terorism Act. Legislators were prompted to amend the U.S. Criminal Code covering biological agents after learning of a 1995 incident involving the acquisition of plague bacillus from the American Type Culture Collection through the mail by a suspicious purchaser in the state of Ohio. The new law also directed the Secretary of the Department of Health and Human Services to promulgate new regulations regarding the acquisition and transfer of certain biological agents.

The Secretary of Health and Human Services, in turn, directed the Centers for Disease Control and Prevention to develop implementing regulations. The CDC has done so and published a Notice of proposed rule making. The regulations become effective April 15, 1997.

The new regulations contain the following 1) a list of agents (microbes and toxins) considered likely to be of interest to terrorists and establishes a method for changing the list; 2) safeguards to be followed when the agents are transported; 3) a system for tracking the transfer of agents between laboratories; and 4) a protocol for alerting authorities if an unauthorized attempt is made to acquire of the agents.

Public and private laboratories, commercial companies, academic and research institutions, and other facilities that wish to transfer or receive the agents will be required to register their facilities with CDC and the facilities will be subject to inspection.

It is interesting to note that after the Ohio incident which sparked the most recent efforts I have just described, federal regulations were reviewed and found to cover agents of danger to plants and animals, but there were not regulations covering human pathogens, hence the new regulation I have just described.

The regulations were developed with significant input from the scientific community, most notably the ASM and the American Type Culture Collection. On March 5, 1996, representatives of CDC, the ASM, and the American Type Culture Collection presented testimony at a hearing convened by the Senate Judiciary Committee to examine concerns arising from the interstate transportation of human pathogens. The subject of “bioterrorism” was further highlighted at the annual meeting of ASM in May in a symposium “Biological Weapons: Challenges to Health, National Security, Economics, and Science.”

More directly, the ASM Biological Warfare Task Force was closely involved with the CDC during almost all stages of the development of the regulation. When it was published as a Notice of Proposed Rule Making, ASM assisted by contacting through the mail and internet more than 11,000 members who might be directly impacted by the new regulations. Many of the comments and suggestions that were received by the ASM, as well as those from other members of the scientific community, have been discussed in the Preamble to the Final Rule, and many were incorporated into the Final Rule.

In 1972 the U.S. signed the Biological Weapons Convention and destroyed its stockpiles of offensive agents. Since then the U.S. program has been defensive and conducted in the open. Although many other countries became signatories to the Convention, there are claims that some states are still pursuing offensive weapons research and have even produced tactical weapons.

The potential for biological warfare existed in Iraq before the Gulf War and led the U.S. to establish elaborate survellance systems and to equip troops with special defensive measures. Although biological weapons were not found by inspectors sent to Iraq after Operation Desert Storm, many knowledgeable individuals remain suspicious that Iraq had developed biological warfare agents. Continuing corncerns about the biological warfare capabilities of Iraq and other contries, such as Libya, North Korea and Syria have led to renewed debate in federal agencies, the Congress and the scientific community about methods to verify weapons research and development. These concerns extend to prohibiting export of certain kinds of technology. The U.S. Commerce Department has imposed export control over certain technology and material including BL3 and 4 laboratory facilities, complex media, microencapsulation equipment and selected biologicals.

Subsequent to the Gulf War, 136 nations met in Geneva in September 1992 to review the status of the Biological Weapons Convention. The delegates discussed the need for verification provisions. At a previous conference in 1986 four "confidence building" measures were approved by the participants. Each state agreed to exchange information on high containment laboratories, to promote international collaboration through meetings, through publication of relevant research and to report incidents of unusual diseases. To date only 27 nations, including the United States, have submitted reports on high containment laboratories.

At the September 1992 meeting in Geneva the U.S. delegates expressed grave reservations about both the feasibility and utility of a verification scheme. They pointed out that there are thousands of government, industry, and clinical laboratories conducting biological research, and given the relatively simple technology involved in research on certain biological agents, any or all laboratories could be involved. They further noted that industrial laboratories could be seriously compromised if inspectors were to deliberately or even incidentally reveal proprietary information.

Despite their reservations about the efficacy of verification of the Biological Weapons Convention declared during the Bush administration, the U.S. delegation agreed to assess the applicability and drawbacks of various verification measures that could be adopted under the Convention. The assessment was conducted last Spring by a team that included representatives from major pharmaceutical companies, the Industrial Biotechnology Association and the American Society for Microbiology. One working group was charged with identifying those aspects of biological arms control verification measures that may adversely affect U.S. industry and academia if a verification treaty is signed. Other groups worked on the positive aspects of implementation so that a pro-com assessment can be prepared. The U.S. delegation returns to Geneva this June with these evaluations in hand for further discussions on biological weapons verification measures.

Measures examined by the groups ranged from satellite and aircraft surveillance to on site inspection and sampling. The Convention already requires declarations of any research and development related to offensive biological weapons. Further verification measures could well lead to the requirement that all government, industrial and academic institutions that have certain types of equipment-such as fermentors and laminar flow hoods, or that work with certain kinds of organisms-such as pathogens or recombinants, file regular declarations of ongoing activities; these facilities would then be subject inspections which would verify the accuracy of the declarations and detect activities barred by the Convention. Even data that is considered proprietary by many non-governmental organizations might well be required to be made available for review and cultures might have to be submitted for analyses by other nations. The biotechnology industry has expressed serious concerns about the potential impact on research and development that might occur as a result of such intrusive regimes.

The ASM's involvement with biological warfare began during World War II and has continued to the present. The Society's membership has unique knowledge and expertise in microbiology and immunology, and this has given the ASM a particularly important role in decision regarding U.S. policy on biological warfare and defense. The Society's Public and Scientific Affairs Board has played an important role in monitoring and responding to legislative and regulatory issues involvng biological weapons, particularly in recent years. As this review has made clear, there is constant stress between the desire to effectively prohibit and monitor biological weapons activity, while at the same time maintaining the freedom to carry out research in an unfettered manner and to maintain the confidentiality of proprietary information in industry. It is unlikely that a perfect consensus will ever be achieved, but the issues are of paramount importance to human welfare and will continue to be addressed by the ASM.

Biology for Peace

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Introduction

The population of the world of today is faced by a challenge that could threaten even its survival in the near future. The gap between the minority of the privileged population and the great majority that lives in total destitution is increasing and could bring to unforeseen levels of violence, made even more destructive than in the past by the technological means available today. In this context, biologists have a specific responsibility, in two ways: on the one hand, with their science they can contribute to solve some of the greatest problems of the developing part of the world and thus reduce or abolish the reasons for tension; on the other hand, they could offer means of global destruction of human people and of the environment so powerful as they never were in history.

In this presentation, I shall make a brief analysis of the way in which biology can have a positive effect on the future of mankind and describe in particular the Organization I am responsible for, which intends to play a hopefully significant role in helping the humanity of the near future to avoid those dangers.

The problems

Hunger comes foremost to the mind as possibly the greatest adversity pervading large fractions of the population, particularly in Africa, South East Asia and certain areas of Latin America. Very often crops suffer from a great variety of stresses, either due to climatic conditions or to qualities of the earth in which they grow as well as the stress due to pests such as insects, fungi and viruses. Also, the scarcity of fertilisers causes very poor yields in the crops, whilst the presence of a biological pest, be it a population of insects or the arrival of a novel virus, may wipe out the crops of entire regions.

Secondly, an element of misery for the developing world, is the spread of **diseases**, some of which are typical of tropical areas and of difficult living conditions. In this context one thinks immediately of malaria, possibly the greatest health problem of mankind: approximately half a billion people suffer from this disease in the tropical belt of the planet, and the number of deaths it causes in one year is estimated to be to the order of three million, half of which are children. Other infectious diseases are particularly rampant in the developing world, such as those due to schistosomas, trypanosomas and other protozoa, and to viruses, like the hepatites (A, B, C, D and E) and AIDS. However, one must not consider only infectious diseases as problems of the developing world: disorders which are considered typical of industrialized countries, present, in fact, huge problems to the Third World: for instance cervical cancer (the main cause of which is also mostly viral) represents the principal cause of death by cancer in women in Africa and Southern Asia.

In the context of health, and referring to the diseases which are more specific to the tropical world, one observes likewise a great dearth of research addressed to them, in view of the limitation of the health market of those countries, in financial terms: thus, diseases like malaria and hepatitis E (not to mention schistosomiasis and trypanosomiasis) can be considered orphan diseases.

Also, the adversities touched upon briefly above, cannot be taken out of the context of the socio-economical conditions of that part of the world: **poverty and unemployment** are elements which offer the foundation to those problems and prime, so to speak, a vicious circle that, through the difficulties in nutrition and health, aggravates itself. The causes of poverty and unemployment are many, and among them one can certainly consider the scarcity of natural and energy resources, capital and the presence of entrepreneurial spirit.

Also, **pollution** of the environment disproportionately plagues many areas of the developing world, worsening therefore the nutrition and health problems that are discussed above.

On top of all that, one has to consider that the **biological weapons** could unfortunately be relatively easily available also to “poor” economies. They are not difficult to produce, relatively easy to hide, and, in the hands of unscrupulous desperate terrorists could cause incredible damage to large populations.

The Remedies - 1.

Biology for development

Biology can offer today very powerful means, even if not the only means, for solving many of the problems that plague such a large portion of mankind. Through science novel methods can be utilized by the citizens of the countries which suffer most to alleviate and possibly abolish the worst hardships which are due to the present, difficult conditions. Thus, in the field of **nutrition**, the ability to manipulate, almost at will, the genome of higher plants and animals offers a great variety of possible applications to several aspects important for human nutrition. In agriculture, we can improve the nutritional values of the plants of common use in developing countries: for instance, several plant species are relatively poor in proteins as far as quantity and composition are concerned; one can plan to introduce genes in these plants which allow the production in great quantities of proteins as nutritional as human milk. Similarly, one can think of increasing the production of plant species of greater use (such as rice, wheat and maize) by making them genetically resistant to different stresses, such as climatic conditions (extremes of temperature, drought, high salt concentration) or harmful biological agents (insects, fungi, viruses or weeds).

Animal breeding can also draw great advantages from genetic engineering, both for the protection of animal health and for the possible introduction of foreign genes in higher animals, thus improving their nutritional capacity as well as their resistance to infectious agents or to particular environmental conditions. Furthermore, both plants and animals can be "engineered" in order to allow them to produce molecules of particular value, such as drugs of complex protein structure: in this way, one could extract expensive drugs from plants cultured at low price, or from the milk of engineered animals, to assure a continuous, high level and cheap production of useful molecules.

As far as the **health** problem is concerned, genetic engineering approaches offer, in the first place, not only a highly increased possibility of studying the infectious agents and their interactions with the human organism, but also, thanks to this knowledge, they allow for the preparation of novel diagnostics, vaccines and drugs for such diseases. Therefore, for these countries, the application of genetic engineering technologies to the diagnosis and therapy of the diseases prevalent therein, as well as to the study of their molecular basis, is no less important.

Additionally, drugs of great importance for many widespread diseases can be obtained in a safe, efficient and economic way by the genetic engineering approach, such as insulin, human growth hormone, erythropoietin, etc. These biotechnology-based products require limited investments and have a high added value. From this consideration, it follows that biology can give a very effective hand to solve the **socio-economic problem** of this less developed part of the world by offering new ways to industrial development and therefore to the creation of wealth and employment. In particular, the new biotechnologies based on genetic engineering can offer both new industrial products and new methods to obtain traditional products, in conditions particularly fitting to developing countries. In fact, biotechnology-based products and processes are typically low-demanding in terms of capital investment, energy, and strategic raw materials, whereas they depend essentially on qualified personnel and on raw materials of biological origin. In this context we may quote, in the first place, the industrial production of new diagnostics, new vaccines and new drugs. In a similar way the industrial processing of food or feed and the most effective utilization of agricultural waste-products can be markedly improved by the new biotechnologies.

The **chemical industry** may also be partly renewed by the utilization of bioreactors, that is of chemical reactors based on biological organisms or on biologically derived molecules. This can give rise to a totally new chemical industry which is much less demanding in terms of capital investment and energy requirements than the traditional one, while being at the same time environmentally friendly. Also, the **mining industry** can be positively affected by the new biotechnologies, by improving the properties of micro-organisms currently utilized for the concentration of important metals, typically copper (mineral leaching).

Furthermore, the **protection of the environment** can be effectively aided by novel scientific approaches: the use of specific micro-organisms may, for instance, remove heavy metals from the polluted areas in a way similar to those utilized for mineral leaching. More importantly, several micro-organisms or micro-organism-derived molecules (biosurfactants) may prove essential for the reduction or removal of oil spills and for the cleaning of oil residues in tankers. Finally, one must consider the use of biopesticides to substitute the chemical pesticides which are widely used in many tropical countries and which may cause several problems for the environment. Another approach is to introduce the genes for biopesticide production directly in the plants, making them genetically resistant to the pest, and thus reducing, or abolishing, the need for chemical pesticides.

Ultimately, the scarcity of **energy** also plaguing many parts of the Third World can be addressed by the novel biotechnologies: the utilization of agricultural waste by genetic engineering could offer a way of exploiting important renewable energy sources in an efficient way. Likewise, the improvement in fermentation procedures can offer ways to more efficiently utilize energy sources (such as ethanol, methanol or methane) derived from renewable material or from organic waste. The utilization of micro-organisms capable of partially metabolizing the hydrocarbons can allow for the exploitation of the remaining oil from the well (the so-called tertiary recovery of oil). This can potentially multiply the extent of available energy resources derived from fossil hydrocarbons. Also, the bioleaching approach can also be applied to the cleaning of coal sources rich in heavy metals: this would make an important energy source available by rendering it less aggressive to the environment.

Finally, as far as **biological warfare** is concerned, the modern biotechnologies offer tools of unprecedented specificity and sensitivity to monitor the respect of the Convention on Biological Disarmament: PCR-based methods, with carefully selected primers, following adequate concentration of the atmosphere and dust of a given environment, could allow the detection of traces at level of the single molecular fragment of the passage of a dangerous organism.

The Remedies - 2.

The International Centre for Genetic Engineering and Biotechnology

The International Centre for Genetic Engineering and Biotechnology, ICGEB, was set up 15 years ago with the aim of exploiting the new sectors of genetic engineering and biotechnology, in order to help raise the living standards of peoples in developing nations and alleviate suffering through scientific research in the life-sciences. Operating through twin centres in Trieste, Italy and New Delhi, India, ICGEB today counts 41 Member States, many of which host Affiliated Centres. This organization has its roots in a decision taken in 1981 at the United Nations agency UNIDO, the organization concerned with industrial development. Recognizing the vast potential of advances being made in genetic engineering and biotechnology, not least for application in developing countries, scientists at UNIDO proposed the establishment of a centre of excellence for fostering biotechnology, considered a key to alleviating disease, hunger, and to economic progress of the developing world. This concept was approved the following year, and the Statutes of the Centre were signed by 26 countries at a meeting in Madrid.

The immediate outcome was ICGEB, whose establishment and subsequent development have been guided, under the aegis of UNIDO, by a panel of scientific advisers and by a preparatory committee of representatives of the Member States. In 1994, the Statutes entered into force, and signatory countries which fully complied with the requirements of international law to be party to an international agreement became Member States. The following year an Agreement between ICGEB and UNIDO for the transfer of assets signalled the beginning of full autonomy for ICGEB as an **International Autonomous Organization** composed now of 41 Member States. At present there are 56 Signatory Countries which have subscribed to the ICGEB

Statutes - the difference represented by nations yet to ratify the Statutes. The decision for ICGEB to become autonomous has meant that the Centre, whilst closely collaborating with UNIDO, is today a novel organization under the general UN umbrella, but administratively independent.

During the preparations for this phase, activities had already begun, starting in 1987, while full operation in terms of scientific research, production of results, training programmes and advisory services, was reached in 1992. These activities are designed to achieve the ICGEB goals of increasing awareness in biotechnology, and offering programmes that strengthen a nation's R&D capability, specifically by:

- providing developing countries with a necessary "critical mass" environment to pursue advanced research in biotechnology;
- training schemes and collaborative research with Affiliated Centres to ensure that significant numbers of scientists from Member States are trained in state-of-the-art technologies, in areas of direct relevance to the specific problems of their countries;
- acting as the coordinating hub of a network of Affiliated Centres that serve as local nodes for the distribution of information and resources located at ICGEB.

Located in Trieste, Italy and New Delhi, India, the Centre forms an interactive network with Affiliated Centres in Member States. In its two Components, ICGEB now has many different research groups working in spheres related to health, nutrition and the environment. Research projects on topics such as hepatitis, gene therapy, cancer, malaria, transgenic rice and cotton are targeting the special needs of the less-developed countries. Work published this year alone, and including techniques to combat malaria, treatment of anaemia, HIV-1 dynamics in infants, and improvement of cotton and rice crops, demonstrates just how critical the research is globally, and in particular to developing countries. It is important, too, that through the Affiliated Centres, ICGEB is working directly in the field, bringing help precisely where it is needed, and boosting the research capability of developing countries.

At present, ICGEB in its two Components together hosts over one hundred fifty scientists, including senior and junior scientists, and trainee fellows from the Member States. In addition, there are around sixty technicians and thirty-five administrative staff.

The scientific activities of ICGEB are reviewed and monitored by a Council of Scientific Advisers of eleven members (including two Nobel laureates) who also report their advice to the Board of Governors, the governing body of ICGEB formed by one representative per member country.

ICGEB has a comprehensive biotechnology programme in Trieste and New Delhi: intensive scientific research is performed in a total of eleven research groups. In addition to research, there are several training and other schemes in action, such as the awarding of fellowships for post-doctoral researchers and for Ph.D. programmes organized in both Components as well as the organization and sponsoring of meetings and courses.

The main areas of the research programme are:

- human health, with emphasis on infectious disease control, vaccine production, and genetic diseases;
- plant biology, with emphasis on crop improvement.

The New Delhi Component concentrates its activity on plant genetic engineering, on malaria and on hepatites. At the Trieste Component, research is focused on molecular and cell biology, virology, microbiology, protein structure and function, molecular pathology, molecular immunology. Scientists working in Trieste collaborate with biologists at SISSA (International School for Advanced Studies), an international university in Trieste and the International Centre for Theoretical Physics, and also have access to a powerful source of X-rays generated by the synchrotron Elettra, located close to ICGEB.

Of course, the operation of ICGEB goes far beyond the Components of ICGEB, in Trieste and New Delhi. In fact, these two laboratories form an active network with the Affiliated Centres in Member States, established research institutes which have attained, or have the potential for, research at high standard. The Centres of this international network host many of ICGEB's training activities and channel the resources and services of ICGEB to local institutions. In addition, a Collaborative Research Programme encourages joint effort between ICGEB and the Affiliated Centres, with the development of new research programmes of specific relevance to participating countries. Another initiative that ensures the transfer of know-how to where it is needed and useful in developing countries involves the drawing up of several agreements between ICGEB and the industrial sectors in Member States.

In all its activities, ICGEB promotes co-operation with international agencies, to bring together and accelerate common programmes. In addition to strong ties with UNIDO, ICGEB has close contacts with WHO, FAO, UNEP, UNESCO, IAEA, OECD, the Commission of the European Communities, and the European Molecular Biology Organization and Laboratory.

The more basic aspects of the scientific programme of ICGEB offer technologies and knowledge essential for the overall scientific programme. Also, it might be stressed that the most important aspect of the ICGEB scientific programme is the **capability building**: that is, the training of high quality scientists, and the help in their return to their country and not only performing appropriately high quality research there but also providing the local industries with the state-of-the-art know-how essential for either development of original products or management of acquired licences. This capability building is, arguably, the most cost-effective way of improving the productive capacity of developing countries. In fact, ICGEB devotes a large part of its energy to long term training (that is pre- and post-doctoral fellowships for Member Country scientists who are involved in the ICGEB scientific programme for a minimum period of one year) as well as the short term training, that is the participation of Member Country scientists in short courses (theoretical and practical) workshops etc. Consequently, and subsequently, the Collaborative Research Programme will help those scientists to establish themselves again in their country and perform high quality work there.

It is obvious that, in terms of its scientific programme, the ICGEB is not unique: several laboratories all over the world, in fact, perform similar or related projects to those approached by ICGEB; what makes ICGEB unique is the fact that this Centre is the property of its Member Countries, which are mainly developing countries: the Member Countries, in fact, run it and can influence its activity: the scientists who come from the Member Countries to work at the ICGEB are not simply guests, but are participating in a project which is also their own. It is also expected that any useful results coming from this scientific programme, as well as the knowledge acquired by the scientists who come to work in ICGEB are all addressed to the advantage of the developing Member Countries: any new technology developed in ICGEB will be made available, even if protected by an ICGEB owned patent, to the Member Countries and to their scientists, with the principle of assuring them the maximum scientific and productive advantage from the use of advanced science. Considering that the ICGEB is the only operating laboratory in the field of genetic engineering and biotechnology within the realm and with the ideals of the United Nations, the Centre has to be considered a unique scientific resource for the developing world.

The Possible Role of the ICGEB in Assuring Biological Disarmament

In an effort to diminish or abolish the hazards of the possible use of biological weapons, an International Convention has been established that intends to ban completely all research and production activity aimed at the obtainment of biological weapons. Three main reasons can be advanced for considering a positive interaction between the Convention and ICGEB and the instrumental role the latter could play.

1) ICGEB's unique nature and its spectrum of activities
2) ICGEB's increasing role in international fora, of which the BWC is an important aspect
3) ICGEB's pro-active character as a centre of excellence for research and training in modern biology.

1) ICGEB's unique nature and its spectrum of activities

The fact that ICGEB started its operations when the spirit of reform was already blowing throughout the United Nations system has given it a unique advantage over older, larger and more bureaucratic international institutions in so far as its management has been careful to run its operations in an extremely efficient way while minimising the administrative load and reducing the cumbersome bureaucracy. Moreover, the Centre has maintained the peculiarities of a modern research institution. So, while ICGEB is governed by UN rules and regulations and keeps its formal link with the System, it is able to maintain a high degree of operational flexibility on a day-to-day basis.

In this context, it is useful to recall the objectives spelt out in article 2 of the ICGEB Statutes and see how, on the one hand, they have been translated into action through the main activities carried out in the last 10 years by the Centre and to consider, on the other hand, the relevance of these objectives and activities for the primary role ICGEB can play in the transfer of biotechnology for peaceful purposes and the role it could play in the implementation of article X of the Biological Weapons Convention.

“a) To promote international co-operation on developing and applying peaceful uses of genetic engineering and biotechnology, in particular for developing countries;
b) to assist developing countries in strengthening their scientific and technological capabilities in the field of genetic engineering and biotechnology;
c) to stimulate and assist activities at regional and national levels in the field of genetic engineering and biotechnology;
d) to develop and promote application of genetic engineering and biotechnology for solving problems of development, particularly in developing countries;
e) to serve as a forum of exchange of information, experience and know-how among scientists and technologists of Member States;
f) to utilize the scientific and technological capabilities of developing and developed countries in the field of genetic engineering and biotechnology; and
g) to act as a focal point of a network of affiliated (national, subregional and regional) research and development centres.”

Moreover, ICGEB has already been quoted by the Convention’s Third Review Conference in the context of the international assistance to facilitate biotechnology research and transfer to developing countries. In addition, the substantial role ICGEB could play in support of a verification mechanism of the Convention has been stressed in a study prepared by a Group of Experts on all aspects of verification for the 50th session of the General Assembly of the United Nations.

2) The concept of clearing house and the increasing role of ICGEB in international fora

In the light of the provisions contained in Article X of the BWC and the subsequent transfer of technologies, especially to the developing countries, the need to create a sort of clearing house mechanism entrusted to an international Authority has become more evident in the past few years.

On the other hand, in the present global context, the international vocation of ICGEB as a "two-way" gateway through which the flow of information and know how could be accessible to all member Countries, and eventually to other non-member developing countries, is becoming more and more crucial.

Thanks to its networking arrangement with its affiliated national laboratories, through its short and long term training activities and with its already well established information systems (see below), could have a major role to play within the overall strategy of a clearing house approach. The Centre would be able to effectively contribute to information sharing mechanism through which both developed and developing countries would exchange information on a fair and equitable basis, a mechanism through which ICGEB could also assist its member Countries on matters relating to biosafety and intellectual property rights.

If properly utilised, the importance such an instrument would have for the international community, cannot be underestimated.

3) *The pro-active character of ICGEB as a Centre of Excellence for research and training in modern biology addressed to the needs of the developing world*

The fact that ICGEB remains first and foremost an international organisation dedicated to research and training in modern biology gives it the particular characteristics of modern scientific institution where the activities already well underway in some fields of specific interest for the implementation of Article X of the Convention would only need to be extended or increased for them to impact significantly on the major issues relevant to Article X of the Biological Weapons Convention, by way of illustration:

Training activities: an enlargement of the annual course organised by ICGEB on biosafety could be instrumental for providing technical assistance aimed at the gradual upgrading of national biological safety practices in the States party to the Convention while constituting a proper framework for the enhanced involvement of donor countries in the field of biosafety.

Collaborative Research Programme: an increase of this programme, in connection with more precise information on the outbreaks of emerging diseases, production of new vaccines and diagnostic reagents, would allow for an enhanced circulation of information, thereby improving the conditions of life in certain countries and, more generally, raising the level of confidence among the Parties to the Convention.

Scientific Information Services: apart from offering advice for scientific programmes, ICGEB also provides its Member Countries with access to the most important biological data bases through the ICGEBnet, a bioinformatics network and through BINAS (Biosafety Information Network Advisory System) developed in conjunction with UNIDO. ICGEBnet and BINAS, apart from being important research tools could also be adapted to the needs of the Parties to the Convention and become major repositories of data on good manufacturing practices, safe laboratory procedures, biological containment. Besides, they would give to the Parties and to the concerned Authority the access to information on releases of genetically modified organisms and on other experiments which could be related to biological weapons or which could entail environmental risks beyond national borders.

To conclude, these are only a few examples to show how, by enlarging the scope of its already well established activities, ICGEB could make its facilities and expertise available through its programmes whilst exploiting its unique nature of a universally recognised independent scientific institution within the UN system.

Building upon its expertise and capability, ICGEB would be in a position to offer a high quality input to the clearing house mechanism and its participation would also minimise the costs involved since it would be possible to keep the general expenditure at a minimum level.

Conclusions

In this presentation, I hope I have given a clear analysis of how biologists in general are burdened with great responsibilities today for the future of mankind, and I have given an example of how an effort is at least being made for facing these responsibilities through an international organization like the ICGEB. The Centre's scientific and technical capacities are available to contribute to dispelling the dangers of biological warfare and to decreasing the tensions that could threaten the peaceful progress of all the communities of the world.

Understanding Peace in the Context of Science: a Historical and Ethical Look at Biological Warfare

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Abstract

The history of biological weapons and defense development is filled with important ethical decisions that shed light to a significant modern concern – the role of science in the development of peace. The unifying moral and ethical principles inherent in religion may provide the necessary link to foster proper consciousness of the threat of biological warfare.

Science for Peace. The value of understanding science in relation to concepts of peace is often under-emphasized. The world has begun shifting into a global society. A society that emphasizes resolving differences by peaceful means. A society that builds development on advances in science and technology. Ironically, science and peace making have rarely been placed into the same arena. It is unusual to see science structured in terms of peace. The institutions and research organizations have for years focused on developing technology and science for 'the advancement of society.' Often, the efforts have helped peace development. But rarely have efforts directly been made at using science for the unique purpose of developing peace. What is needed is a comprehensive analysis of Science for Peace. The history of biological warfare development is filled with some of the most important arguments and considerations common to both science and peace. It is here that science and peace meet. It is here that Science for Peace can begin to be understood. It is here that an exercise of Science for Peace can be preformed. What follows is an examination of biological weapons development in the context of ethical issues that are over and above what is being undertaken technically by scientists and politically by the international community.

However, an ethical understanding is not enough. A modality of action needs to follow. Past efforts have concentrated on international documents and agreements and the analysis of scientific social responsiblity to foster awareness and control of biological weapons development. However, the fact that biological weapons continue to be developed illustrates the need for a more integrated approach. The world public opinion needs guidance toward a more permanent solution. Such guidance may only be possible by fostering major changes in universal conscience. Religious or spiritual, ethical, and political systems offer three of the most influential avenues for fostering universal change. If these three systems can be integrated into a single comprehensive approach, the change can begin.

Religion & Morality

An analysis of the religious dimension of morality will help in understanding the underlining ethical issues inherent in a discussion of biological weapons development. After all, central to every document, agreement, and discussion of biological warfare are the issues of ethics and moral values. In an utopian moral and ethical world, not only would the need for biological weapons be avoided, but the motives for development would also disappear. In developing biological weapons, the scientist is placed in a situation where certain morals must be compromised. Conscious development of weapons of mass destruction is a test of true ethics and morals. Understanding moral and ethical standards in relationship to religion may help to develop the integrated approach needed for a universal change.

The question of whether religion has a direct or indirect effect on morality has been debated for years. Nonetheless, the overwhelming opinion of philosophers and religious thinkers is that the two are linked and constantly influence each other. Virtually every society has established some form of myth or religion to standardize and explain morality. The first explanations of morality began with identification with the divine. Supernatural powers were responsible for dictating codes and laws that standardized morality for that particular society. Examples such as the Code of Hammurabi and the Ten Commandments illustrate such a dependance on the divine. However, the development of society and religions resulted in an integration of philosophical morality, independent from divine doctrine. What remained constant was the interrelationship between religion and morality. Each religious doctrine reflects ethical, moral, and social values: the humaneness of Confucianism; personal holiness of Judaism; agape, or love of Christianity; compassion of Buddhism; and brotherhood of Islam.[130] As the Encyclopedia of Philosophy explains, “the human needs that morality serves, nonaggression and cooperation, are everywhere the same; and it is not surprising that intelligent beings, reflecting on their experience, have evolved broadly similar codes for meeting them” (Nowell-Smith).[129] If all religions contain stresses on nonaggression and cooperation, it is necessary then, to find ways to take advantage of these principles.

It is at this junction that biological weapons and universal morality converge. For a biological weapon to remain a threat, aggressive countries must preserve the biological threat. Thus, cooperation is avoided, and secrecy is required. True biological warfare is thus secretive and aggressive by nature, the antithesis of the common morals central to all religions: cooperation and nonaggression.

Keeping in mind the universal principles of morality common to religions, it is now necessary to understand the historical development of biological weapons.

Historical Analysis

Biological weapons have been present for centuries. Biological historians cite cases of biological warfare as early as 300 B.C. (Poupard and Miller)[1] when the Greeks used diseased corpses and beasts to pollute water supplies of enemies. While the methods of disease transmission were far from being understood, early societies soon learned the power of disease. The history of infectious agents is filled with dramatic effects on human society and institutions. Civilizations have risen and fallen; wars have been won and lost; religions have gained and lost strength; all at the microbes hand. However, it is modern society that has been challenged most by biological weapons. Although military strategists in the late 1960s dismissed biological warfare as having little strategic value in battlefield situations and even less in the age of nuclear weapons (Poupard and Miller),[2] biological weapons have now been recognized as a tremendous threat. President Richard Nixon, in 1969, labeled biological weapons “repugnant to the conscience of mankind,” with the potential of causing “massive, unpredictable, and potential uncontrollable consequences” (Cole).[3] It was with that statement that President Nixon renounced biological warfare entirely and pledged to destroy the United States’ biological arsenal. But the true potential of biological weapons has only recently been fully accepted. The reality of the biological arsenal of Sadaam Hussain during the 1991 Gulf War, the growing biological programs of many developing countries, and the attractiveness of biological warfare as an alternative to resource dependant nuclear warfare, have resulted in a consciousness of the intense threat of biological warfare. The potential danger of this type of warfare is made worse by a few convenient features. Biological warfare is invisible, silent, widely available, and easily obtained.

The Geneva Protocol

For many, however, the threat of biological warfare is nothing new. Recognizing the dangerous potential of chemical weapons after the onslaughts in World War I, several attempts at controlling its development were made. Following a series of treaties mentioning chemical warfare dating back to the mid-19th century (See Appendix I), the first major attempt was made in 1925. In response to the general awareness of the potential of biological and chemical weapons, the Geneva Convention produced the 1925 Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or Other Gases, and of Bacteriological Methods of Warfare (Poupard and Miller),[4] known as the Geneva Protocol (See Appendix II). Though originally the Protocol was drafted only against chemical warfare, lobbying by the Polish delegation resulted in the inclusion of biological warfare restrictions (Mobley).[5] While the true motivation for the Geneva Protocol was a response to the use of chemical warfare in World War I, the agreement banned the use of both chemical and biological weapons in war. Yet, there was no prohibition of development, manufacturing, or stockpiling of agents as retaliatory weapons. The Geneva Protocol outlawed "first use," but not retaliation. The United States did not immediately ratify the Geneva Protocol due to pressure from the US chemical industry and the US Army Chemical Warfare Service to allow the preservation of their developments. In fact, ratification did not take place until 1975 (Goldsmith).[6]

The tense political atmosphere after post-World War I led to several weakness in the agreement. Charles Flowerree of the Committee for National Security cites three major weakness of the Geneva Protocol[7]:

1. It says nothing about research, development, or stockpiling of chemical or bacteriological weapons, creating a situation in which many countries "adhered" while maintaining the right to respond in kind if their forces are attacked with these weapons.
2. The term "bacteriological" may not include all possible types of biological warfare agents (viruses, for example).
3. There are no provisions for investigating or ensuring compliance.

What soon resulted from the lack of provisions was the early development of biological warfare research facilities. In 1929, the USSR opened a facility north of the Caspian Sea, and in 1934, the UK and Japan officially followed. The Japanese biological research program was the most developed and by far the most controversial

Japanese Biological Warfare Program

Even before the official 1934 decision to develop biological weapons, the Japanese had begun their attempt to become the world's pre-eminent biological warfare power (Harris).[8] The Japanese program was unique. The Japanese military recruited the top scientists, physicians, dentists, veterinarians, and technicians to participate. Together, these researchers began an ambitious attempt to become the world power of East Asia. What resulted was a true test of ethical consciousness, as men, women, and children were used as experimental subjects. They were subjected to horrifying experiments, and those who survived were sacrificed when they no longer were useful. The case of the Japanese Biological Warfare Program is a useful lesson of ethical considerations for the scientist as well as the statesmen.

The beginnings of the Japanese Biological Warfare Program began with Koizumi Chikahiko, the Japanese Army's Surgeon General, who, as early as the mid-1920s, supported studies on biological and chemical warfare. It was Koizumi's belief that biological and chemical warfare would allow Japan to fulfill its ambitious expansionist goals. Koizumi soon discovered Major Ishii Shiro, an army doctor who would soon lead the Japanese Biological Warfare Program. Ishii realized the potential power of biological warfare immediately. After reading the Geneva Protocol, he saw a great opportunity in developing a weapon that was being proscribed. In 1930, Ishii was appointed Professor of Immunology at the Tokyo Army Medical School, where he first began his research on biological warfare. His research in Tokyo showed potential, but it was Ishii's belief that animal experimentation would not be enough. The only way to accurately determine the true utility of biological weapons was to develop a comprehensive program of human experimentation . Ishii Shiro never was educated in ethics. He had grown up in a country filled with ultra-nationalists proclaiming nationalism and ethnocentricity (Harris).[9] For Ishii, the ethical question of human experimentation was secondary to military success.

Towards the end of 1932, Ishii set up a laboratory in the industrial city of Harbin, Manchuria, the newly acquired Japanese colony. Known as the Togo Unit, the laboratory location proved to be unsuited for the large scale human experimentation that Ishii desired. Secrecy was too difficult. The decision was thus made a year later to move the laboratory to the village of Beiyinhe, 100 km south of Harbin. The largest of the 100 buildings, in Beiyinhe, the Zong Ma Castle, was a combination of small holding prison for future subjects, laboratories, crematorium, and ammunition dump. In 1935, the prisoners rioted. After an ammunition dump exploded mysteriously a year later, the camp was ordered destroyed (Harris).[10]

By the fall of 1936, Ishii's program had moved to Ping Fan, a suburb of Harbin. The local population was informed that a lumber mill was being built. Ironically, the human subjects at Ping Fan were regarded as "marutas," or "logs." Ishii was given command of a new unit, known from 1937-1941 as the Ishii Unit, and later as Unit 731 (Harris)[11].

Ping Fan was the largest of the research centers, but it was not the only one. A biological research center was established in Changchun. Known as Unit 100, the Changchun research center was led by Major Wakamatsu Yujiro, a military veterinarian, and operated independently from Ping Fan. Another center was established in Manchuria's most important industrial city, Mukden. The research facility in Mukden was led by Kitano Masaji, a Professor in the Manchurian Army Medical College, who would later replace Ishii as head of Unit 731 in 1942 (Harris).[12]

The human experimentation was essential to each of the Japanese biological weapon research facilities. Humans were tested with virtually every known pathogen, chemical pesticide, and poison. Diseases included: plague, typhus, smallpox, yellow fever, tularemia, hepatitis, gas gangrene, tetanus, cholera, dysentery, glanders, anthrax, scarlet fever, undulant fever, tick encephalitis, "songo" or epidemic hemorrhagic fever, whooping cough, diphtheria, pneumonia, typhoid fever, epidemic cerebrospinal meningitis, venereal diseases, tuberculosis, salmonella, and other diseases that affected local populations in Manchuria and China. Over 10,000 human subjects were used (Harris).[13]

In July 1937, large scale tests began. Soon, reports from China described extensive Japanese use of chemical and biological weapons. From 1939-1942, Japan conducted twelve major field tests. In October of 1940, the town of Chuhsien was sprayed with rice and wheat mixed with plague-infested fleas. The result was 21 deaths. In January, a similar attack was made on

Ningpo. The children of Nanking were given chocolates infected with anthrax in July of 1942 (Mobley).[14] By 1943, China convinced President Franklin D. Roosevelt to condemn the Japanese actions. Roosevelt threatened to retaliate against Japan if the "inhumane form of warfare" did not end (Harris).[15]

The response to the Japanese actions made by the United States was surprising. At the end of World War II, trials for war criminals were held. Major Ishii Shiro did not attend. Instead, a secret agreement was made with the entire Japanese Unit 731 (Freeman).[16] Interviews were made with the Japanese scientists to collect biological warfare information. The American representatives sent to Japan ensured the scientists that any information released would not be used as evidence in war crime trials. The interviews continued for three years. The United States was well aware of the human experimentation that was performed. However, neither ethical nor moral issues were ever discussed. Over 5000 Japanese were tried as war criminals. Not one high level Japanese biological warfare expert was charged with a crime. Ironically, the data gathered held little value. The United States Biological Research Program soon surpassed the Japanese. The information from human experimentation lost its valued utility (Harris).[17]

World War II

Although the Geneva Protocol had banned the bacteriological weapons, the 1940s witnessed the most intense development and stockpiling of biological weapons. Joining the Russia, the U.K., and Japan were the United States and Canada, who, by 1941, had opened their biological weapons development centers. It was a period of instability in the world. Throughout the 1940s, plans for biological warfare and defense were being prepared by most of the world powers.

At the start of World War II, biological warfare programs of several countries were ready for action. The Allies were highly suspicious of the state of their enemies biological warfare programs. By 1942, the Allies had reached the same conclusion that the Japanese had made from their experimentations: anthrax was the choice agent for biological warfare. Anthrax spores were rugged, and could endure the high temperatures of explosions, making them an easy attachment for conventional warheads. In 1942 and 1943, under the joint effort of British, Canadian, and United States biological research programs, the Microbiological Research Establishment at Porton experimentally infected Gruinard Island, off the north-west coast of Scotland, with anthrax (*Bacillus anthracis*).[18] So severe was the experimentation on Gruinard Island, that the island was off-limits to civilians for nearly a half-century. In the early 1980s, it was reported that anthrax could be detected only in the limited area of experimentation. Only recently has Gruinard Island been Ôre-opened.’ On May 1, 1990, the island was sold back to the original owner for £500 (Aldhous).[19]

Additional preparations were made by the Allied forces. 5,000,000 anthrax-infected cattle cakes were prepared for usage by Britain. The plan was to infect cattle, resulting in a war-time food shortage. By 1943, the Allies were preparing 500 pound anthrax bombs for war.

The Gruinard Island experiments, as well as Allied preparations in general, were a result of fears that Germany had also developed a comprehensive biological warfare program (Aldhous),[20] and of intelligence reports of German and Japanese intentions (Doyle and Lee).[21] Intelligence reports in 1944 that Germany was prepared to launch powerful V-1 “buzz bombs” with biological agents prompted even more fear. The threat was made by Hitler in his Danzig speech on September 19, 1939. Hitler spoke of a secret weapon that could not be used against him (Mobley).[22] The German high command was getting desperate. They had reached a strategic crisis, and saw the use of biological warfare as a mean of gaining a permanent advantage (Bernstein).[23] As a precautionary measure during the D-Day invasions, 100,000 Allied troops were given “self-inoculating syringes” against the possibility of a biological attack. Additionally, Allied soldiers invading Italy wore shirts drenched with DDT, aimed at preventing typhus (Press).[24]

There exists one final documented use of biological weapons in World War II. In 1942, Reinhard Heydrich was assassinated by the Czechoslovakian underground. The method of assassination has been documented as being biological warfare. A grenade, manufactured in Porton, England, was infested with “X,” the British code name for botulism toxin, and used in the assassination. While Heydrich suffered only minor wounds in the chest and spleen, his death several days later matched the symptoms of botulin poisoning (Mobley).[25]

Regardless of all the preparations that were made, biological warfare never entered World War II in the large scale that was anticipated. The German biological arsenal was harshly exaggerated. For some unknown reason, Hitler had barred all offensive biological warfare research (Bernstein).[26] Allied forces never used the anthrax bombs. The two million anthrax infested cattle cakes never reached the battlefield. In the end, the focus turned to biological warfare’s historical alternative — nuclear warfare.

The United States Biological Weapons Program

The United States Biological Weapons Program began in 1941 under the auspices of the US Army Chemical Warfare Service. By the middle of 1942, the War Research Service, headed by George Merck (president of Merck & Co., Inc.) took over the active research. From 1942 to 1943, the War Research Service allowed the Chemical Warfare Service to expand their own biological research. The Chemical Warfare Service was given millions of dollars to build research facilities, including the 500 acre Camp Detrick (Frederic, Maryland), the 2000 acre Horn Island (Pascagoula, Mississippi), the 250 square mile site known as Dungway Proving Ground (Utah), and the 6,100 acre plant in Terre Haute, Indiana. By 1943, the United States was playing an active role in preparing for World War II, producing anthrax and botulism bombs for Allied forces (Bernstein).[27]

After World War II, the United States led the way in biological warfare research and development. The Cold War atmosphere left Russia the United States' major competitor. In 1947, President Truman officially withdrew the Geneva Protocol from possible ratification, claiming that current developments had already invalidated the principles of the treaty (Poupard and Miller).[28] The United States soon began what would become a series of experimental tests in the non-laboratory setting. Towards the end of the 1940s, the United States worked with Britain and Canada, releasing pathogenic microorganisms from ships in the Caribbean (Poupard and Miller).[29] Open air experiments were conducted in Norfolk, Virginia by the Navy in September 1950. And, In a series of experiments performed by the Army one year later, *Serratia marcescens* and *Bacillus globigii* were released by ships in the San Francisco Bay area. The intent was to discover truly how vulnerable American cities would be to biological attacks. At the time *Serratia marcesens* was viewed as having no pathogenic potential, however, later experiments revealed the contrary (Stanier).[30] A mini-epidemic broke out at Stanford Hospital, resulting in the death of Edward Nevin.

In 1964 and 1965, the Army conducted experiments to determine the vulnerability to smallpox virus. Experimenters dressed in plain clothes wandered the North Terminal bus station and the National Airport in Washington, D.C. Travelers were sprayed with *Bacillus subtilis* through aerosol sprayers concealed in suitcases. The bacteria was thought to be harmless, however it was later determined that the bacteria can interfere with the immune systems of elderly and those suffering from debilitating diseases.[31]

Another documented testing occurred in the New York City Subway in 1966. The Chemical Corps Special Operations Division filled light bulbs with *Bacillus globigii*. The light bulbs were dropped into ventilator shafts of the subway from a moving train. The bacteria was soon carried to the ends of the subway tunnels. The tests were performed on three major lines in the mid-Manhattan area (Huxsoll, Parrott, and Patrick).[32] *Bacillus globigii* was not found to be pathogenic. The conclusions made by these experiments indicated the vulnerability of American cities to biological attack. However, the fact that the American public was oblivious to the testings has led to considerable mistrust of military biological warfare research.

Accusations: the case of the Korean War

The United States has not been the only country to perform tests. The history books are filled with accusations by countries on the possible use of biological warfare in both testing and war situations. The theme of accusations dates back to the fourteenth century outbreak of Black Death. Many European Christians passed the blame to Jews, who were accused of poisoning wells with plague (Moon).[33] During World War I, Germany was accused of using cholera in Italy and plague in St. Petersburg. While these allegations were never proven, Germany never denied them. On the other hand, accusations made by England, that Germany had used plague bombs, and others made by France, that disease-infected toys and candy were used in Romania, were completely denied by Germany (Poupard and Miller).[34] In 1933, the French journalist Henry Wickham Steed claimed that the Germans had released clouds of *Serratia marascens* into ventilation shafts of the Paris Metro and near French forts. These allegations were denied by the German government (Robertson).[35]

Allegations surfaced again at the onset of World War II. China made several complaints of Japanese biological warfare attacks. Originally, these accusations were dismissed as propaganda attempts to attract world sympathy. Soon, however, the world realized the extent of the Japanese attacks. Unfortunately, it took until 1943 for the United States take action against the Japanese regime (Harris).[36]

Accusations peaked in the 1950s during the height of the Korean War with what came to be known as "black propaganda" (Rolicka).[37] In 1951 and 1952, the Communist leadership of North Korea and China claimed that the United Nations Command was using biological warfare. What followed were a series of accusations and denials. Beginning on February 22, 1952, propaganda campaigns were attempted by Communist Korea. According to the propaganda, the United States had launched a biological weapons campaign against North Korea, attempting to start widespread epidemics. Various vectors such as flies, fleas, lice, locusts, spiders, mosquitos, and crickets were used to disseminate diseases such as plague, anthrax, typhus, smallpox, cholera, dysentery and encephalitis (Rolicka).[38] However, the speedy and effective North Korean response helped to spoil the United Nation's plan. China immediately responded with a much-needed public health campaign, using the American threat of biological warfare as a catalyst to encourage hygiene. The charges of germ warfare proved to be a way of getting things done domestically. To support the propaganda, witnesses, laboratory tests, and autopsies were produced to prove the realness of the attacks.

These accusations were soon denied by the United Nations Command and the US Department of State. The first denial was made by the US Secretary of State, Dean Archeson on March 4, 1952. He challenged North Korea to allow the International

Committee of the Red Cross to perform an impartial investigation of the situation (Moon).[39] General Matthew B. Ridgway called the allegations a cover-up of the domestic problems of North Korea. He felt that North Korea made the accusations to hide the government failure to deal with the disastrous domestic health situation (Moon).[40]

The situation of accusations never developed beyond the propaganda level. Several attempts were made for impartial investigations, yet none were performed. At the 18th International Red Cross meeting in Toronto (1952), a special commission was suggested to investigate the charges. However, North Korea failed to respond to the request, based on the feeling that Western influences were attempting to spy. An additional attempt was made by the World Health Organization, which was, once again, refused. Instead, the Chinese chose the International Association of Democratic Lawyers, who was already documenting the atrocities of the American forces, to investigate the biological warfare evidence (Mobley).[41]

Archive research has revealed a significant amount of information clearly pointing to the false propaganda attempts of North Korea. In 1956 a Hungarian journalist, who was in touch with the Hungarian Hospital in Korea, published a paper expressing his doubts regarding his original observations of germ warfare attack. Similar evidence was found about Korean hospitals in general. Polish doctors who had been working at the Polish hospital in Korea, which had been established in 1952, concluded that the Korean hospitals were understaffed, the medical staff was unqualified, and many medics functioned as doctors. Such a situation made it rather easy to falsify information (Rolicka).[42]

The theory suggested by General Ridgway has much support. This suggestion rests on the assumption that epidemics did develop. A 1984 article by Albert Cowdrey supports this argument. Cowdrey feels that the epidemics did occur throughout Korea and China due to “a natural disease environment of singular variety...ills usually associated with cold, moderate, and warm climates flourished – epidemic typhus, malaria, Japanese B encephalitis, cholera, hemorrhagic fever, typhoid, and small-pox, among others."[43] In the beginning of 1951, smallpox and typhus were reported throughout Korea. Mass inoculations followed. However, according to UN Command technical intelligence officers, the diseases seemed to be excessively present in the north. Cowdrey felt that for North Korea, the germ warfare accusations took a "Janus-like form." The propaganda would encourage hatred of the United States, and serve as a motivation to prevent any recurrence of the epidemics that broke out in 1951, through a complex domestic clean-up (Cowdrey).[44]

Regardless of whether there were epidemics, there is no evidence that the United States used biological warfare in the Korean War. In fact, recently recovered documents reveal that the US was not even prepared for biological warfare. In July 1952, the Chairman of the R&D Board declared that the United States probably could not "create a real capability for offensive anti-personal BW by 1954" (Moon).[45] By the end of the Korean War, the US did not possess any biological agent "of high infectivity and satisfactory half life." Additionally, no satisfactory delivery device existed. (Moon).[46]

While it can be argued that allegations during the Korean War were the clearest abuse of biological warfare accusations, the allegations did not end there. In the 1970s, accusations were made concerning "yellow rain." In 1979, accusations were voiced that the Soviets had released anthrax in Sverdlovsk. In 1980, the Cuban government argued that an outbreak of swine fever was the result of CIA action. In October of 1985, the Soviet official Valentin Zapevalov claimed to have found the true origin of AIDS. He said that scientists working for the US biological research program in Fort Detrick had created the virus and began the spread by injecting humans and animals (Seale).[47] A Moscow Radio commentary on December 26, 1985 noted, "Dr.

John Seale of Britain has concluded that the AIDS virus has been artificially created and its appearance is possibly the result of a human error. This conclusion supports the view that the AIDS epidemic has been caused by experiments with humans carried out in the USA as part of the development of new biological weapons" (Medvedev).[48]

The past examples have hinted to the potential danger of biological warfare accusations. Biological agents are often undetectable, thus, accusations are often dismissed due to the nature of the use of biological warfare. Verification of biological warfare use is also difficult. Rarely does one come across a 'smoking gun' leading to an obvious conclusion. Attempts to prove accusations, are, therefore, a vigorous challenge. Often enough, the accusations are ravish attempts to condemn an innocent country. However, in certain situations, exemplified by the Chinese case in World War II, the accusations were true. What results from the large number of accusations is what I will call the "Cry-Wolf Theory." The immediate world reaction to biological warfare accusations is doubt. Countries making accusations are viewed as either attempting to gain sympathy from other nations, or using the accusation for some ulterior motive. When a "true" biological warfare allegation is made, it is often dismissed and overlooked; an unfortunate result of the abuse of biological warfare allegations.

Developments Leading to the Biological Weapons Convention

In 1957 the United Kingdom made a revolutionary decision in regards to their biological weapons program. The decision was made to destroy all offensive biological weapons, allowing only for defensive research to continue. With the United States and several other world powers still actively developing their biological weapons programs, the international arena was not quite ready to follow in the British footsteps.

However, on November 26, 1969 the history of biological weapons development reached a milestone:

> "Mankind already carries in its own hands too many of the seeds of its own destruction. By the examples we set today, we hope to contribute to an atmosphere of peace and understanding between nations and among men" (Press).[49]

It is with this speech that President Nixon officially ordered the destruction of the American biological weapons arsenal. Under UN Supervision, all American offensive biological weapons were destroyed. While this decision seemed to be a revolutionary accomplishment by President Nixon, many argue that Nixon's declaration was based on a purely political rational, without consciously considering the uncontrolability and unpredictability of the weapons (Freeman).[50] Regardless, with the United States leading the way, several other nations reconsidered their biological weapons policies. The political atmosphere was finally ready for a strong international effort to prevent biological weapon development.

In 1972, following President Nixon's renouncement of biological weapons, the Convention of the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction was held, otherwise known as the Biological Weapons Convention (BWC) (see Appendix III). Representatives of 80 nations at the BWC agreed to destroy or convert to peaceful use all biological warfare organisms, toxins, equipment, and delivery systems (Poupard and Miller).[51] The agreement encourages the dynamic exchange of scientific and technological information, materials, and equipment to aid research in biological agents and toxins for peaceful use and treatment of disease (Huxsoll et al).[52]

Periodic Review Conferences were scheduled at the time to update the agreement, and allow for diplomatic developments to be compensated. Since 1972, four Review Conferences have met. As an October 10 issue of *Science* indicates, the treaty is regarded as "the world's first disarmament treaty, as it is the first treaty to outlaw the production and use of an entire class of weapons of mass destruction."[53]

The major criticism of the BWC is the lack of verification mechanisms to ensure compliance. Charles Flowerree of the Committee for National Security believes that the reason for this was that at the time of the BWC there was a "general belief that biological warfare was of little or no military significance" (Flowerree).[54] The Review Conferences have attempted to solve this problem, however a feasible solution has yet to be found.

The largest reason for the current insecurity in the BWC arises from the resurfacing evidence of continued offensive biological research, a product of the verification problem. Each accusation and every discovery of biological weapons development is a direct challenge to the BWC. Between Nixon's declaration in 1969 and 1986, 40 allegations of biological warfare have emerged (Orient),[55] the most significant being the "Yellow Rain" controversy and the 1979 Sverdlovsk accident. Since then, several others have emerged, including the discovery of the large biological arsenals of Saddam Hussein during the 1991 Gulf War.

Yellow Rain Controversy

Beginning in the late 1970s, reports began to surface of biological and chemical warfare in the areas of Laos and Kampuchea. Allegations were made by the United States that the Soviets were using what was described as "yellow rain" as a biochemical war agent. Several witnesses testified to the fact that they had seen or been the victim of such warfare. On September

13, 1981, Secretary of State Alexander Haig made the following declaration to the Berlin Press Conference:

> "For some time now, the international community has been alarmed by continuing reports that the Soviet Union and its allies have been using lethal chemical weapons in Laos, Kampuchea and Afghanistan. We now have physical evidence from Southeast Asia which has been analyzed and found to contain abnormally high levels of three potent mycotoxins — poisonous substances not indigenous to the region and which are highly toxic to man and animals" (Meselson, et al.)[56]

Matthew Meselson led the investigation of the mysterious yellow rain. After traveling to Southeast Asia, he began an intense investigation of the accusations made regarding "yellow rain." He established a comprehensive analysis consisting of interviews, chemical analyses, and descriptions. Most interesting was the chemical analysis.

Investigations and testing of the mysterious substances were performed by the US Army, the University of Minnesota, and Rutgers University. Chester J. Mirocha, of the University of Minnesota reported five of six samples to be positive for the poisons. The other positive tests came from Robert Rosen and Joseph Rosen of Rutgers University concluded that while "it has been implied that the mycotoxins in the State Departments samples analyzed by Mirocha could have been naturally occurring...the information obtained in this study, in which four mycotoxins and a synthetic material were found in the same sample, suggests otherwise."[57] However, the US Army, after testing more than 80 samples, failed to find a single sign of the toxins.

Meselson concluded that the accusations placed on the Soviet Union were false. In fact contrary to the State Departments claims, the mysterious "yellow rain" was not a form of biochemical warfare, but rather the feces of Southeast Asian honeybees. The reports of yellow clouds of biowarfare, Meselson explains, were in fact showers of honeybee feces that occur often in the Tropics of Southeast Asia, “the yellow rain: it is a phenomenon of nature, not of man” (Meselson, et al.).[58] Despite attempts to re-establish the theory that “yellow rain” was a clear act of warfare (Rosen),[59] Meselson’s theory remains the accepted theory.

Sverdlovsk Anthrax

Around the same time that accounts were beginning to surface regarding “yellow rain,” two events were taking place. On March 1980, the First Review Conference of the BWC was held. It was during the March conference that the United States revealed information alleging that the April 1979 outbreak of anthrax in Sverdlovsk was a result of the release of anthrax spores from a Soviet military complex. The complex, they claimed, was working on the development of biological weapons. The outbreak resulted in ninety-six cases of human anthrax and sixty-four deaths (Meselson, et al).[60]

The first report of the anthrax outbreak was reported by the East German magazine, *Posev* (Orient).[61] Soviet news agencies and officials admitted to the outbreak, but attributed the spread to contaminated meat sold on the black market. However, US intelligence made claims to the contrary. The US felt that the outbreak was consistent with an accident at the Military Compound 19 in Sverdlovsk, however, the Soviet story never changed. At the time of the publication of the July 21, 1984 issue of *The Lancet*, both Matthew Meselson and Zhores Medvedev (a noted critic of the Soviet military) had accepted the Soviet version,[62] however many questions remained unanswered.

In an attempt to uncover evidence to the cause of the 1979 anthrax outbreak, Meselson renewed previously unsuccessful attempts to have independent scientists investigate the Sverdlovsk outbreak in 1986. The request was granted in 1988. The reports from the Soviet scientists indicated the number of infected individuals and deaths. In 1990, a series of articles published by Russian scientists regarding the 1979 outbreak surfaced. It was revealed that in 1979, research on an anthrax vaccine was being performed. In May 1992, Yeltsin acknowledged that "the KGB admitted that our military developments were the cause." Meselson still felt that further investigation was needed. In June 1992, Meselson was granted an invitation to visit Sverdlovsk and begin an on-site study. The conclusions stated that "the outbreak resulted from the windborne spread of an aerosol of anthrax pathogen...the source was at the military microbiology facility..the epidemic is the largest documented outbreak of human inhalation anthrax" (Meselson, et. al.).[63]

Combined with the reports of "yellow rain," the Sverdlovsk anthrax outbreak of 1979 was a devastating blow to the First Review Conference and the entire BWC efforts. After all, the USSR was one of three Depositary Governments established by the BWC to ensure ratification of the Conference. The two events clearly demonstrated the extent of the verification problem inherent in the BWC. Both events were an indication of active development and stockpiling of biological weapons, in violation of both the Geneva Protocol and the BWC.

The 1991 Persian Gulf War

The entire international community went through a tremendous eye-opening experience during the 1991 Persian Gulf War. As Middle East editor of *Newsweek* Christopher Dickey put it, "for several days at the end of 1990 and the beginning of 1991, the world stood on the brink of the first holocaust ever caused by biological weapons."[64] Twenty-two nations joined the United

States against Iraq, a member of both the Geneva Protocol and the Biological Weapons Convention. The war marked the first time that complex offensive and defensive biological weapons systems were prepared. By studying the expectations and preparations made for the Gulf War in comparison to the reality of the Iraqi biological arsenal, it is possible to understand the extent of biological warfare possibilities.

By the beginning of the Gulf War, intelligence sources had known about the Iraqi biological warfare program for two years. The Iraqi program had been actively researching botulism, anthrax, typhoid, cholera, tularemia, equine encephalitis, as well as several other biological agents. Biological weapons were being developed in research laboratories in the villages of Samarra and Salman Pak. Although a new Genetic Engineering and Biotechnology Research Center was opened in Baghdad, it was understood that the technology was not yet advanced enough to develop effective genetically engineered biological weapons. In August of 1990, it was reported that “there is good reason to believe that Iraqi President Saddam Hussein has boasted to other Mideast leaders that biological warfare is what will ultimately stop the United States should it decide to attack Iraq (Knudson).[65]

With the knowledge of the extent of the Iraqi biological arsenal, several preparations were made. Specially designed Mission Oriented Protective Posture (MOPP) gear was designed for both biological and chemical warfare. However, according to Major Gregory Knudson of the Area Microbiology Service at Letterman Army Medical Center, while this protective gear might be sufficient for chemical warfare, it would not be sufficient for the biological warfare that Saddam was prepared to use.[66] Thus, researchers in Fort Detrick, Maryland, home of the United States Biological Defense Research facilities, began developing a variety of vaccines, drugs, and other means of combating the biological threat. Intelligence and researchers felt that the biological agent most likely to be used would be *Bacillus an-*

thracis and botulinum toxin. Thus, troops were given vaccinations against anthrax and botulinum toxin, and several other vaccines were stockpiled for possible use including tularemia, Query fever, Rift Valley fever, and Argentine hemorrhagic fever (Marwick).[67] While most held the possible biological warfare attack as a distinct possibility, others felt that the likelihood of Iraq using these weapons was doubtful. Advocates of the latter view feel that "heavily defended US positions, with troops in MOPP gear using gas-detection devices and decontamination kits, atrophine injectors, and medical support... [as well as] the threat of massive retaliation" is enough to deter any possible Iraqi attack. However even advocates of this view agree that if this deterrence fails, the large number of civilian and military casualties would be massive (Marwick).[68]

In retrospect, estimates of the Iraq's biological arsenal were significantly miscalculated. A GAO report noted that at the onset of the Gulf War, the United States Army's vaccine stockpile for botulism and anthrax was significantly less than what was needed (Horgan).[69] In September 1995, Iraq admitted the extent of their biological weapons program. At least twenty-five missile warheads containing 5,000 kilograms of biological agents were prepared. Additionally, an extra 15,000 kilograms of biological agents were armed inside bombs to be dropped from airplanes or to be reserved for other weapons. If these weapons had been used in addition to the Scud missiles which reached Tel Aviv, "the result could have been as horrifying as Hiroshima or Nagasaki" (Dickey).[70]

The most likely reason that Saddam Hussein chose not to tap into his biological arsenal was the forceful warnings that were made by the United States. In January 1991, Iraq was warned that the "most extreme measures" would be chosen if weapons of mass destruction were used. Iraq most likely interpreted this to mean that the United States would retaliate with nuclear measures (Dickey).[71] Additionally, the preparations made by the United States may have helped in deterring an Iraqi attack. Nevertheless, Saddam Hussein's verbal threats of a biological weapon attack were never substantiated. No practical preparations were made, and Iraqi troops were never immunized against any of the agents (Goldsmith).[72] Regardless of the fortunate outcome, the 1991 Persian Gulf War illustrated the realness of the threat of biological weapons.

Informed Consent and The Nuremberg Code

An interesting development occurred during as a side-effect of the 1991 Gulf War. Just before the war began, the US military faced a significant dilemma. In order to successfully prepare for the possibility of chemical and biological warfare in the war, US troops were to be administered several vaccinations. However, the military foresaw a potential problem – the possibility of some troops declining the vaccinations. According to US statutory law, informed consent is needed for all "investigational use" of drugs, with the exception of when consent is "not feasible" or professionally determined to be "contrary to the best interests of such human beings."[73] Thus, the ultimate decision would rest in the soldier. If the soldier decided against the vaccination, then based on his rights of informed consent, the soldier would have the option of non-administration. However, if every soldier was not given the important vaccinations, the entire Desert Storm Operation might have been disrupted. Thus, the military pursued a waiver of requirements for informed consent for the use of these drugs. The Food and Drug Administration (FDA) granted the military request by issuing rule 23(d), allowing waivers of informed consent on a drug-by-drug basis. The FDA explained that consent was "not feasible in a specific military operation involving combat or the immediate threat of combat."[74]

A large debate broke out in reference to the ethics of this decision. Opponents to FDA 23(d) used the Nuremberg Code as their major argument. The Nuremberg Code was devised to establish ethical and humane guidelines for human experimentation. The first, and most well known of the ten-point code emphasizes the voluntary and informed consent of the subject being absolutely essential. Since some of the agents being used in the Gulf War were considered experimental agents, by ignoring the voluntary consent of the troops in the Gulf War, the United States was in clear violation of the Nuremberg Code. Opponents of FDA 22(d) argue that the Nuremberg Code has no exceptions for wartime situations. Neither should the US government.[75]

Attempts were made by the Public Citizen Health Research Group to prevent the military from using the experimental agents without informed consent, however the FDA 23(d) was already in the workings (Marwick).[76] George J. Annas of Boston University Schools of Medicine and Public Health argued that "the most important thing we have learned is that informed consent is feasible in combat situations, and therefore rule 23(d) was unnecessary... General Norman Schwarzkopf, whose command did not seek or want the informed-consent waver, ordered that the botulinum-toxoid vaccine be given only with informed consent."[77]

More and more reports have been recently surfacing regarding Persian Gulf Syndrome (PGS). While no direct connections have been made between biological or chemical warfare and PGS, the potential exposure of the US troops is still a distinct possibility. A recent study suggested that the Persian Gulf Syndrome was caused by a beef allergy that developed as a result of an immunization take prior to the war.[129] As reports of PGS grow stronger, it might be necessary to look at all aspects of the war, including the vaccinations made in preparation.

Ethical Analysis

Understanding the historical facts of the history of biological warfare is not enough. Several important ethical issues need to be discussed, and lessons need to be learned. Ethical considerations are inherent in biological warfare, yet biological warfare presents a situation where ethics can easily be overlooked. Individuals like Major Ishii Shiro were never taught the basic ethical values of life. Sheldon Harris of California Sate University concluded his analysis of the Japanese biological warfare developments in the 1930s and 1940s by saying,

> "It is evident that the moral issues relating to biological warfare have not affected many of the world's scientists as the twentieth century draws to a close. The frightening examples of the Japanese biological warfare experiments, as well as those of the Nazi doctors, have not deterred those who still seek fame and fortune, regardless of ethical considerations."[78]

Developments in biological warfare have reached a point where ethical considerations are a necessity. To what extent is research of biological warfare ethical at all? Is offensive biological warfare research different from defensive research? Where is the threshold between the two? Is the biological researcher completely responsible for the outcomes of his or her research? It is these questions that demand an ethical analysis of biological warfare.

In 1986, Doyle and Lee from the University of Louisville published a paper entitled "Microbes, warfare, religion, and human institutions." The underlying premise of the paper was an attempt at educating microbiologists. It was stated that a significant number of microbiologists are unaware of the role biological warfare has played in the history of mankind. The paper discusses the tremendous effect biological warfare has played in shaping the outcomes of war, developments and success of religions, and success and downfalls of civilizations. "There is a need for microbiologists to have a historical perspective of some of the major ways in which a pathogen may influence civilized populations. Conditions may exist in contemporary society for a repeat of some of the kinds of plagues suffered by previous societies" (Doyle and Lee).[79]

Individual Efforts Towards Standards of Ethical Responsibility

Scientific developments are constantly under the ethical microscope. Several attempts have thus been made at establishing a universal standard of ethics in science, and social responsibility. However, few of these theories have directly assessed the role of biological warfare within the scientific paradigm. The social responsibility of the scientist is a well debated topic. Sir Solly Zuckerman notes the difficulty of creating universal standards, "When one talks about the social responsibility of scientists, it is thus carrying naiveté to the extreme to suppose that they speak with one voice and that they share a common conscience when it comes to the application of scientific knowledge" (Chalk).[80]

Others, however, have made solid attempts at deriving ethical standards of social responsibility. In 1941, British historian J. G. Crowther suggested eight ethical standards for scientists, urging the consideration of possible social implications of their work, recommending political activity to help establish forces to regulate the conduct of research, and, in cases of war, advising the scientist to "consider which side was the less inimical to science, and then do what was possible to see that it was not defeated" (Chalk).[81]

In 1947, just after the bombings of Hiroshima and Nagasaki, a heated debate developed between Norbert Wiener and Louis

Ridenour over Wiener's decision not to "publish any future work... which may do damage in the hands of irresponsible militarists." Wiener, a MIT mathematician, felt strongly that "to disseminate information about a weapon in the present state of our civilization is to make it practically certain that the weapon will be used." Ridenour challenged Wiener, emphasizing the problems with Wiener's interpretation of social responsibilities, and the implementation of such responsibilities. Ridenour felt that the social responsibility of the scientist is no different than that of "every other thinking man." And, in war time situations, when the nation is preparing for war, any attempt to impede preparations for war should be avoided (Chalk).[82]

At the heart of the ethical analysis of scientific research as a whole, especially biological warfare research, is the extent to which a scientist can be held responsible for his or her research. Is the scientist completely responsible for all possible outcomes of the research? Newtol Press commented on this problem with an interesting analogy to Fritz Haber, a German scientist who was awarded the 1918 Nobel Prize for Chemistry for his work in ammonia synthesis. Two other French Nobel Prize winners declined their awards on the grounds of Haber being "morally unfit" for the honor, as his work played a major role in the development of poison gas:

> "Ethicists sometimes say that spoons have been used to gouge out eyes and argue from this example that makers of tools have no responsibility for the ways their products are used. What holds true for spoons does not apply to poison gas. Haber had no illusions and was never publicly repentant; he believed that he was doing the right thing, that he was serving a noble end with an efficient means" (Press). [83]

In an article on ethical responsibilities in science, Daniel Callahan of the Hastings Center commented, "Life is a gamble...

so, for that matter, is science... science can, directly and indirectly, produce useful knowledge and help improve the human lot. It can also, directly and indirectly, bring about great harm." Callahan continues by stating four moral propositions for scientists and researchers:

"1. Individuals and groups are ordinarily responsible only for the consequences of those actions that are voluntary and intentional on their part. However, they may also be held responsible for the unintended consequence of their actions if, through negligence, they failed to take into account such consequences.
2. Individuals and groups cannot be held responsible for these actions the consequences of which are totally unknown. However, if they voluntarily undertake such acts, they may be held responsible for the consequences unless there were serious reasons for undertaking the action in the first place. One cannot, without serious reason, just "play around" in the unknown while simultaneously disclaiming responsibility for the results.
3. When others may be affected by our actions, they ordinarily have the right to demand that their wishes and values be respected. This is particularly the case when those actions may result in harm to them.
4. Individual scientists and scientific groups are subject to the same norms of ethical responsibility as those of all other individuals and groups in society. They have neither more responsibility for their actions nor less; there is no special ethic of responsibility applying to scientists that does not apply to others."[84]

In the context of biological warfare, Callahan explains that each individual scientist should base research decisions on his or her own moral principles. It is the obligation of the scientist to evaluate a proposed research assignment and decide whether the goal being sought is moral or immoral. If the scientist concludes that the goal is immoral, the scientist should withdraw

Figure 1

The Pledge Against the Military Use of Biological Research

"We the undersigned biologists and chemists, oppose the use of our research for military purposes. Rapid advances in biotechnology have catalyzed a growing interest by the military in many countries in chemical an biological weapons and in the possible development of new and novel chemical and biological warfare agents. We are concerned that this may lead to another arms race. We believe that biomedical research should support rather than threaten life. Therefore, WE PLEDGE not to engage knowingly in research and teaching that will further the development of chemical and biological warfare agents."

from the work. Callahan is firmly against those who say "if I don't do it, then someone else will," or "I personally believe what I am doing is wrong, but I was not the one who made the decision to pursue this line of investigations."[85] Callahan admits that while his outlook on moral and social responsibilities may seem like a heavy burden, the scientist who evaluates his or her work and hypothesizes on a worst-case-scenario basis will not act in a "morally irresponsible way."[86]

Leonard A. Cole of Rutgers University in his paper entitled "Ethics and Biological Warfare Research," agrees with Callahan's "imagination principle" of analyzing all possible harmful outcomes of a scientists research. He adds, however, that in the case of biological weapons research, an additional element must be considered: the legal element. All biological researchers, Cole states, "should be familiar, for ethical as well as legal reasons, with applicable statutes and regulations. In the area of biological research, some work might be inappropriate while not being explicitly legal" (Cole).[87]

Efforts To Preserve Ethical Responsibility

Apart from individual attempts to standardize ethical and moral evaluations of science and biological warfare research, there have been several cases of individuals and groups playing the role of activists against biological warfare research.

Newtol Press mentions a Soviet scientist who was investigating a mathematical model for the spread of influenza virus. After realizing the potential for an "influenza pandemic," the scientists ordered an international review of his work to deter using it for the development of biological weapons.[88] The scientist, after evaluating the potential danger of his work, took an active role in preventing such work, using his own standards of ethical responsibility to come to such a realization.

More and more scientific societies are acknowledging the need for open discussion of biological warfare related issues. Many others are establishing ethical committees to evaluate standards on ethical practice. Cassell, Miller, and Rest focused their article, entitled "Biological Warfare: Role of Scientific Societies," on the American Society for Microbiology (ASM), the largest life sciences organization. The ASM Committee on Ethical Practices is responsible for the ASM policy on biological warfare, and historically, has taken an active role in biological warfare awareness. The ASM Archives co-sponsored 1990 and 1991 conferences on biological warfare, and played a significant role in President Bush's May 1990 signing of the "Biological Weapons Anti-Terrorism Act of 1989" (Cassell, Miller, and Rest).[89]

In 1988, the Reagan administration attempted a fourfold increase in US military funding of biological research. In response to this proposed increase, the Council for Responsible Genetics developed a pledge for scientists against biological warfare (see Figure 1)[90]. By August of 1988, five hundred sixty researchers had signed the pledge (Norman).[91] By the August 1989 publication of *JAMA*, over eight hundred scientists had signed the petition (Jacobson and Rosenberg),[92] and by May 1990, more than one thousand (Shulman).[93] While the Council for Responsible Genetics, led by Jonathan King, has witnessed success as an activist organization, it is not alone. Physicians for Social Responsibility has, for many years, opposed secrecy and unethical practices in biological warfare research, and has been a strong supporter of the 1972 BWC. Physicians for Social Responsibility feels that physicians share the responsibilities of the misuse of science. Their efforts concentrate on eliminating what Victor W. Sidel, MD labels "weapons of indiscriminate mass destruction" which pose "the greatest threats to the health of the people of the world" (Goldsmith).[94]

In 1984, planning began to develop a maximum containment lab at the US Army's Dungway Proving Ground, seventy miles southwest of Salt Lake City. The laboratory was to be the testing site for extremely hazardous biological agents, and would be one of five to possess P4 containment facilities. The plans were met with significant protest. Leading the way was Jeremy Rifkin, a leading critic of biotechnology, and the founder of the Foundation of Economic Trends, who brought the proposal to court. The court ordered a complete analysis of all possible environmental and public health side-effects (Norman).[95] Noted individuals like Moselio Schaechter, a molecular biologist at Tufts University, explained the fears felt by many scientists, "a lot better work can be performed in this lab, both for defensive as well as offensive purposes. By and large, there is no way to tell the difference. They are exactly the same." Richard Goldstein , professor of microbiology and molecular genetics at Harvard University agrees, "In my mind, the opening of this facility substantially escalates the biological arms race" (Smith).[96] The 1984 plans never passed Congress, as Senator James Sasser withdrew his approval after realizing that the Pentagon "sought a reprogramming action under emergency fund statutes in order to avoid the regular authorization and appropriation process of the Congress" (Smith).[97] In

1988, attempts to revamp efforts at building the facility began again. Immediately, opposition groups were formed in Utah, and a petition was signed in August by more than one hundred forty biological professionals protesting the Army's plans.[98]

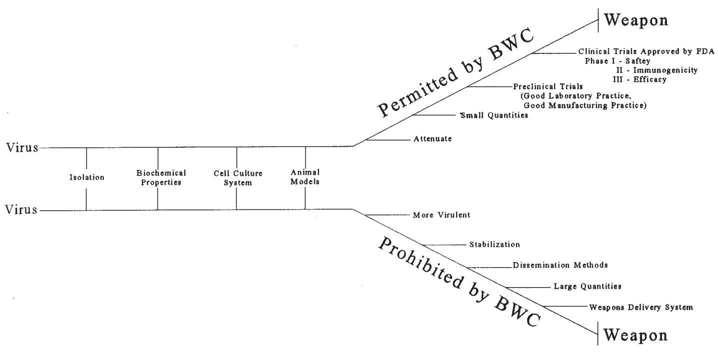
Biological Weapons Defense Research – The Ethical Debate

At heart of the Dungway Facility argument is the potential use of biological research. Jonathan King, who sponsored the pledge campaign for the Council for Responsible Genetics, argued that the major problem with biological research is that it is impossible to differentiate between defensive research to be used for completely defensive purposes, and defensive research that could be used for offensive developments. King's advice, "if it is really for civilian purposes, let's put the money into NIH" (Norman).[99] This argument has been used by many critics of military biological research. What has resulted is a heated debate between those that favor military defensive biological research by the Department of Defense, and those, like King, who are diametrically opposed. Is biological research by the Department of Defense justified? Is it moral? Is it needed? An examination of the arguments of both sides will help clarify many significant ethical problems and questions.

Arguments in favor of military-led defensive biological research have mostly been developed by individuals within the military, especially from the US Army Medical Research Institute of Infectious Diseases (USAMRIID) at Fort Detrick, Maryland. There are several points that these authors emphasize.

At the heart of most of the arguments concerning defensive research is the difficulty in distinguishing between what is considered defensive research and offensive research. Major Michael E. Frisina, assistant professor of philosophy at the US

Figure 2



Military Academy, notes three major reasons that defensive research is distinguishable from offensive. Firstly, the BWC delineates the two types of research, allowing defensive research for the development of vaccines. Secondly, the ends of the two types of research are diametrically opposite. Defensive research attempts to develop a vaccine, while offensive research develops a weapon. The path to obtaining these two ends begins the same, but soon diverges intensely (see Figure 2). For a vaccine, only a small amount of experimental virus is needed, while in weapons production, the virus is developed into large quantities and placed into a delivery system. Finally, Frisina discusses his empirical research model. The empirical nature of defensive research differs from offensive. For offensive research, additional production of virus and testing of delivery systems are a necessity. These steps are missing from defensive research.[100] Additionally, defensive research at the USAMRIID uses naturally occurring agents and is unclassified.[101] These three points point to a practical distinction between defensive and offensive research.

Huxsoll et al, reporting from the USAMRIID, notes political reasons for defensive biological research. It is important for the United States to continue to support the BWC and research against biological warfare. Many countries turn to the US for leadership in medical defense. Stopping defensive research would be a signal that the US is no longer supporting the BWC, and the US credibility and defense would be "seriously weakened."[102]

Proponents also cite moral justifications for defensive research. It is the moral reasons that are emphasized most and given the most importance by advocates of defensive research. Each country has a moral obligation to protect its soldiers and defenders. An additional moral obligation is placed on those associated with the healing profession, who have are morally obliged to promote health. Included within promoting health is the development of vaccines to protect both civilians and soldiers. As Major Frisina put it, "thus defensive biological research to develop special vaccines for the military is a pragmatic and moral necessity."[103]

An interesting analysis was presented by Joseph Martino of the Research Institute at the University of Dayton. His paper discussed the role of military-sponsored research at universities. Martino discusses five major arguments against military biological research:

"1. All war is immoral; a university should have nothing to do with military activity.
2. Although defensive wars can be moral, weapons of mass destruction, such as nuclear weapons, are morally inadmissible, and a university should not conduct any research that might contribute to their development.
3. A university is devoted to the preservation and enhancement of culture. It should not support warlike activities because their practical result is the obliteration of culture.

4. Classified DOD research, which contradicts the demands of academic freedom, should not be conducted on a campus.
5. Although some amount of DOD research is acceptable, the current level of dependence of universities on DOD funding leads to militarization of the university" (Martino)[104]

After refuting each of these arguments, Martino concludes that military biological research is moral and ethical, "to ask about the ethics of Department of Defense-sponsored research in the university is to get the question wrong. It implies either that there is something inherently unethical about the DOD... attempting to draw the line between the university and the DOD is to put it in the wrong place...the proper place to draw the line is between immoral research and any researcher, regardless of whether he works in a university, in industry, or in a government laboratory" (Martino).[105]

On the other end of the spectrum stand many of the activists who argue against defensive biological research. Historically, it is argued, defensive biological research has led "inevitably to offensive biological warfare research" (Harris).[106] Jacobson and Rosenberg site three major problems with defensive research[107]:

"1. The research may be highly dangerous to surrounding communities if virulent infectious organisms are released.
2. The research, even if truly defensive in intent, can be viewed by a potential military adversary as an attempt to develop protection for US military forces against an organism that the United States might wish to use for offensive purposes, thus permitting the United States to protect its own personnel in a biological "first strike."
3. The borderline between offensive and defensive research on biological weapons is usually impossible to draw, since effective research on defenses may require testing and validation against potential offensive organisms. The fact that defensive medical

> research is being conducted by a branch of the US Army may appear ambiguous and may lead potential adversaries to conclude that the research is in part directed toward developing new materials for offensive use" (Sidel).

In response to arguments made by Huxsoll et al that there is a distinctly different path to developing vaccines than development of weapons (see Figure 2), Victor Sidel, chairman of the Working Group on Chemical and Biological Weapons for Physicians for Human Rights and Physicians for Social Responsibility, notes that the early steps in the development of vaccines leaves a large potential for the dissemination of diseases. As an example, Sidel describes an incident that developed at the University of Massachusetts in early 1989[108]. Microbiologist Curtis B. Thorne had been researching anthrax with funding from the US Army's biological defense programme. A large protest was held by nearly two hundred students, residents, and outside experts who feared that Thorne's research was a health risk to the entire community. Richard P. Novick, a molecular biologist and director of the Public Health Research Institute New York, supported the protests, claiming that the research "could not be construed as for peaceful purposes" (Shulman).[109] These same fears can be extended to the international community. Questions may soon arise whether countries involved in defensive research are actively developing biological weapons, possibly resulting in a biological arms race.

A strong argument against defensive biological research has been made by Jonathan King of the Committee for Responsible Genetics. This "no participation" argument, as Major Michael Frisina calls it, has several components. King argues that "the spread of disease is so unpredictable and the range of biological agents that could be used is so large that the very concept of defending against biological warfare is misleading... offensive and defensive biological weapons programs have the same components. The data gained form the defensive biological weapons testing is the same information needed to develop offensive capabilities." Research for vaccines and other defenses is thus essentially offensive, and a violation of traditional ethics of healing (Frisina).[110]

Others argue that vaccine research is pointless. Variations of biological weapons are so diverse that "vaccines against our home-grown bug would probably not work against a strain with slightly different surface properties"(Press).[111] Defensive research is thus forced at developing a large arsenal of possible agents, leaving the possibility of developing a specific agent into an offensive weapon.

Several possible solutions to the debate have surfaced. For the most part, both sides agree that openness in research is the key. The major fears of the anti-research groups is the potential development of biological weapons. By releasing all aspects of the research, the public, especially special interest groups, would be able to keep a close eye on the developments. What the military cannot do is practice a policy of trust and secrecy. The suspicions will continue until a free flow of information is established.

In 1989, US Congressman Wayne Owens sponsored two resolutions regarding biological defense research. The first, HR5241, required that the National Institutes for Health perform "all federal research, development, testing, and evaluation of the medical aspects of the use of biological agents in the development of defenses against biological warfare." The second, HR 806, would require the Secretary of Defense to publish an annual *Federal Register* of the current stockpile of biological agents. The argument behind both of the resolutions was stated by Representative Owens, "there is nothing uniquely military about biomedical research, which is why the medical portion of the Biological Defense Research Program belongs under the civilian control of the National Institutes of Health" (Gunby).[112]

While these two bills were never passed, an additional bill (HR 237 and S 993) that implements the BWC on a domestic level, adding criminal penalties for domestic violence, passed in May 1990. The passage was regarded by Jonathan King as, "a very important step [in] ensuring that biotechnology is developed for peaceful means" (Shulman).[113]

Still the debate continues. Doubts as to whether defensive biological research is moral or justified still cloud the mind of the researcher. At this point, it is up to the individual ethics of the scientist to decide whether to continue research or not. This is where comprehensive ethical decisions and moral judgements are an important necessity.

Future Possibilities for Prevention

Recent developments in technology have made biological weapons an even more dangerous option. Genetic engineering and biotechnology offer biological weapons a completely new dimension. Additionally, the appeal of biological weapons to terrorists and Third World nations has stirred even more fears. What has emerged is a situation that necessitates awareness, precaution, and action. The BWC is the only current control measure for biological weapons. However, additional efforts have begun at developing alternative measures to help control the growing threat of biological weapons.

Much of the second review conference of the BWC was concentrated on the threat that genetic engineering brings to biological weapons development. At the conference, the US submitted a paper warning about the potential problems that modern technology brings:

> "Verification of the Convention, always a difficult task, has been significantly complicated by the new technology... The ease and ra-

> pidity of genetic manipulation, the ready availability of a variety of production equipment, the proliferation of safety and environmental equipment and health procedures to numerous laboratories and production facilities throughout the world, are the signs of the growing role of biotechnology in the world's economy. But these very same signs also give concern for the possibility of misuse of this biotechnology to subvert the Convention" (Flowerree).[114]

This statement illustrates the potential problems that biotechnology brings to biological warfare. Concerns at the conference were met by a series of agreements known as "confidence building measures": exchange of information concerning all high-level containment facilities that house genetic engineering developments, the status of individual national biological defense programmes, and outbreaks of infectious diseases. Additionally, the second review conference encouraged the publication of scientific findings on vaccine development, and more contact between researchers (Freeman).[115] Despite efforts at controlling the threat added by biotechnology, concerns still exist.

As a weapon of mass destruction, biological weapons are much more tempting to a power-hungry militant leader than nuclear weapons. Nuclear weapons are significantly more difficult to develop, and are considerably more expensive. Biological weapons, known for many years as "the poor man's atomic bomb," are easy to obtain, and much easier to develop. Newton Press reports that "it is actually possible to set up a laboratory in a house trailer and to equip a functional research facility for thousands of dollars rather than millions."[116] These traits leave biological weapons a potentially popular option to Third World powers or terrorist groups. As witnessed by Iraq during the 1991 Gulf War, Third World countries now see biological weapons as an easy route to world power. Third World nations learned an important lesson from the Gulf War: the superior technology of developed countries will outmatch the limited ar-

Figure 3

Biological Weapons Convention
Article X

...[the signatory nations] undertake to facilitate, and have the right to participate in, the fullest possible exchange of equipment, materials, and scientific and technological information for the use of bacteriological (biological) agents and toxins for peaceful purposes. Parties to the Convention in a position to do so shall also co-operate in contributing individually or together with other states of international organizations to the further development and application of scientific discoveries in the field of bacteriology (biology) for the prevention of disease, or for other peaceful purposes.

senals of the Third World. Aggressive Third World leaders are beginning to see biological weapons as the only way to contend with larger world powers. As we approach the 21st century, regarded by many as the Biological Age, biological weapons will become more and more tempting to modern warfare.

What these threats amount to is a significant need for control and cooperation to develop the technologies of biological warfare for peaceful means. Several individuals have developed methods at aiding this effort.

In response to the 1991 Gulf War, a conference was held on April 4 and 5, 1991 entitled "The Microbiologist and Biological Defense Research: Ethics, Politics and International Security at the University of Maryland Baltimore County. A book containing contributions from the meeting was subsequently published in a December 1992 edition of the Annals of the New York Academy of Sciences. During the meeting, a dinner talk was held discussing the outlook on biological weapons development and control. Carl-Goran Heden of the Biofocus Foundation Project of the World Academy of Art and Science published an article entitled "The 1991 Persian Gulf War: Implications for Biological Arms Control." The article stressed the lessons to be learned from the war, and discussed several alternative ways to develop biological research.

Firstly, Heden points out that the distinction between haves and the have-nots goes beyond access to resources, technology, food, and water. The distinction also is results from the availability of knowledge and lack of opportunities to use that knowledge. The gap between the haves and have-nots can be narrowed by sharing of knowledge and information. Cooperation in science and technology offers such an opportunity. He adds that bioengineers have an enormous potential to apply their skills to cooperation and peaceful developments. Bioengineers can help solve short-term environmental problems and make long-term contributions to solving ecological problems of their region. By sharing information and know-how resulting from peaceful developments in biotechnology, Heden feels that we can start the developing world on its way to a "biosociety."

Heden's most interesting suggestion is concerned with combating the proliferation of biological weapons. Heden emphasizes that, in his opinion, the way to combat the rising threat of biological warfare is to develop Article X of the BWC (See Figure 3) which "enjoins signatory nations to cooperate in the peaceful development of applied microbiology. This action needs to be supported by an implementation program that combines the resources of the United Nations system and appropriate scientific non-governmental organizations and brings them to bear on preventing development of biological weapons and fostering development of microbiology for humanitarian purposes" (Heden).[117] Heden's proposal is developed in detail by Raymond A. Zilinskas from the Center for Public Issues in Biotechnology at the University of Maryland Baltimore County.

Zilinskas dedicates his article to a detailed description of a new technical agency – the Biological Hazards Early Warning Program (BHP). The BHP would be an international agency dedicated to deterring the development of biological warfare. The BHP would, however, contain an additional agenda. It would be an international agency responsible for reporting and investigating any unusual outbreaks in diseases and attempt to determine their origin. In light of the fact that "international trust in the BWC is not being enhanced," the BWC would help strengthen the confidence-building measures set forth in the BWC and its subsequent review conferences.

The focal point of Zilinskas' plan to strengthen the BWC is placing more emphasis on Article X of the BWC. In fact, Zilinskas and Heden advised the second BWC review conference to take such action. They advised the review conference to raise necessary funds and work with the International Council of Scientific Unions to develop an international program that would include "training, short-term exchange visits, joint research between scientists and between laboratories, and linking institutes via computerized communication networks. Participating scientists would have a moral and professional obligation to report suspicious activity to their professional organization as they carry out their normal activities of research, teaching, and training." Although RC3 agreed to carry out the advice, funding was never provided (Zilinskas).[118]

Details of the BHP are developed in an article published in the *Annals of the New York Academy of Sciences* article entitled "Confronting Biological Threats to International Security: A Biological Hazards Early Warning Program." Zilinskas discusses in detail the BHP purpose, structure, legal justification, and funding. One of the most significant aspect of the BHP would be its ability to enhance international arms control and security from biological threats through early detection, monitoring, and suppression of diseases.[119]

Attempts to prevent the spread of biological weapons must go beyond the BWC, as the ethical dilemmas of biological weapons span beyond the collective level. Individual efforts of scientists are the source of biological weapons development. What results is a question of social responsibilities, morals, and ethics.

In attempting to derive possible solutions to the problem of moral and social responsibilities, Rosemary Chalk of the Institute of Medicine at the National Academy of Sciences in Washington, DC, discusses establishing a reference of "unlawful science." She suggests to "develop a list of weapons that are banned by international treaty and to formulate an international protocol urging scientists of every nation to refuse assignments that directly contribute to the development of such weapons" (Chalk).[120]

Leonard Cole offers an additional policy approach to solving the ethical problems of biological warfare. He suggests establishing a consultative agency to review biological research, and answer any ethical questions or doubts. He recommends the Institutional Review Boards, who currently oversee experimentation on human subjects, as a possible agency to fulfill this role.[121]

The role of the physician in the biological field can not be underemphasized. After all, it is these professionals who develop biological weapons and their defense. As Alan H. Lockwood, MD of SUNY at Buffalo School of Medicine and Biomedical Science explains, "Our professional responsibility should compel us to be leaders in the process that will prevent [chemical and biological weapons] proliferation and lead to their abolition."[122] Unfortunately, most medical training does not emphasize awareness, preparation or treatment of biological threats. It is this subject that Surgeon Lieutenant Commander a G Robertson of the Royal Australian Navy and Major Morgan-Jones of the Royal Army Medical Corps discuss in their article "First Line Nuclear, Biological and Chemical Defense Training – The Way Ahead." The discussion emphasizes the need for a protocol for medical professional training, citing a need for "training at paramedic, first line medical officer, medical specialist, nursing officer and medical services officer level." They mention six aims of this protocol:

> “First, it should complement the single service general NBC training given to all personnel and provide a good foundation from which the student could progress onto other more advanced courses such as the Chemical Defense Science Course and the DRPS Senior Medical Officer’s Radiation Protection Course. Second, the training should provide treatment protocols to support the medical person in the field. Third, as the principles of treatment are applicable to all three services, it should be organized on a tri-service basis utilizing tri-service resources. Fourth, the training should be based on the basic resuscitative principles of the Battle Acute Trauma Life Support (BATLS) concept. Once developed, these concepts can be applied to other toxicological emergencies, e.g. in industry, and could be usefully applied in the training of civilian physicians. Fifth, training should initially be developed for junior medical and dental officers as they are most likely to be required to put these concepts into action. Specialized courses for medical specialists providing third and fourth line care, paramedics, nursing staff and other health service personnel should then follow. The medical specialists would then form a nucleus for development of coherent responses by National Health Service staff. Finally, there should be revision courses every three years to ensure that personnel remain current” (Robertson and Morgan-Jones).[123]

Commentary

Tremendous lessons can be learned by understanding biological warfare and biological weapons development. Biological warfare has been present for thousands of years, yet only recently has the potential threat been understood. Nonetheless, this threat is growing. Although great efforts have been made at curtailing the proliferation of biological weapons, development continues. A 1994 Pentagon report noted that as many as twenty-five nations including North Korea, Iran and Iraq, are currently developing biological weapons. Many already possess biological stockpiles.[124] If successful deterrent does not come soon, many other countries will join the list. The Biological Weapons Convention of 1972 provides the basis for such deterrent. It contains the guidelines for successful control of the biological threat. However, the document alone is not enough. What is needed is international cooperation by all countries to adhere to the regulations of the Convention. History has taught us that biological research and weapons development can be abused. One only needs to look back as far as World War II to discover the lack of morals and human decency that took place in prewar Japan. Leaders like Ishii Shiro are not alone. More and more aggressive and unscrupulous leaders are emerging in the modern world; leaders who see little need to consider ethical and moral values in devising their plans to become world powers. It is these leaders and terrorists that pose the most intense threats. Biological weapons are easy to create, easy to hide, and difficult to detect. The propensity of these individuals to take advantage of the "poor man's atomic bomb" becomes more and more realistic as time progresses and development continues.

From an ethical standpoint, this creates a threatening problem. New moral obligations must now be considered in performing biological research. The scientist must be fully aware of what he or she is about to embark upon. The potential of biological technology falling into the wrong hands grows larger with time. Lists of ethical standards, moral obligations, and social responsibilities can only go so far. Ultimately, the decision can only be made by the individual scientist. Yet the scientist has the added obligation of awareness. An obligation of understanding the project at hand and the potential abuse that may develop from it. An obligation that attempts to cover all corners, predict the future, and protect for the future.

The time has come to learn from the past. Any miscalculation in the area of biological warfare can be disastrous. Had Saddam

Hussein chosen to use his biological arsenal during the Gulf War, devastation would have resulted. Matthew Meselson estimated that had 200 kilograms of anthrax spores (the amount contained in one Iraqi Scud) been detonated a few feet above ground, it "would kill every living thing – at least all humans and bovids for hundreds of kilometers in the downwind plume" (Dickey).[125] Fortunately, Iraq's biological arsenal was untouched. Yet, the 1991 Gulf War taught the world a valuable lesson about biological warfare; a lesson filled with a need for awareness and precaution; a lesson filled with ethical and moral responsibilities and considerations; a lesson about the importance of understanding the growing threat of biological warfare.

We are living in a time period where peaceful negotiations are rising. Concepts of peace are beginning to fill the "minds of men." We are beginning to understand the root of violence, and are just starting to use the root of violence to combat violence. In 1986, a diverse group of scientists met in Seville to ask an important question, "Does modern biology and social sciences know of any biological factors that are an insurmountable or serious obstacle to the goal of world peace?" The answer was precise, "biology does not condemn humanity to war, and that humanity can be freed from the bondage of biological pessimism and empowered with the confidence to undertake the transformative tasks needed in this International Year of Peace and in the years to come... The same species who invented war is capable of inventing peace. The responsibility lies with each of us."[131]

Violence is thus not genetic. Rather, it is a learned behavior that develops out of environment. Man learns violence. If violent behavior and violent thoughts can be learned; then violent behavior and violent thoughts may be "unlearned." Take for example Western Europe. One would only have to look back to the beginning of this century to find a warring Europe filled with violence. Two of the largest and bloodiest wars in the history of man were fought on this land. The entire world was shocked at the depths of man’s inhumanity illustrated by the two world wars. Yet, soon after World War II, Western Europe began to use the war as an impetus for science. Science and technology flourished. What has manifested itself in the European Community are a group of countries united together through cooperation. The transition is almost complete for Western Europe.

Presently, the social, economical, and cultural attractiveness of weapons has resulted in a unified desire to increase the prestige of a country. Lesser developed countries see weapons development as an easy ticket to stardom; a backstage pass to world reverence. What if the prestige associated with weapons development were to be reversed. What if weapons lost their prestigious value? What if countries began working together on positive developments in science and technology instead of concentrating efforts to the growing technologies of weapons development and war technologies? The case of biological warfare gives a perfect opportunity for such a reversal. What if scientists concentrated on coordinating their efforts at developing vaccines instead of biological weapons on a global level, with full dissemination of all developed technologies to all countries? When these questions are answered with large scale cooperation, scientists will begin to work together on an international level; development of technologies of war will be replaced with the development of technologies of peace. Scientists will be united by a common desire – preservation of peace through science.

How does such a large scale cooperation develop? As an answer to this question, it is necessary to turn to two overwhelmingly influential systems of society: education and religion. It is through these two mechanisms that international cooperation can begin to see success. Merging these two disciplines together may be the answer.

Education will always be the primary means of generating awareness. The effectiveness of education, however, depends on the method of communication. The world needs a lesson on ethics and morals. The educations systems need to begin emphasizing ethical and moral standards at all levels of education. In the scientific community, this emphasis becomes essential. Scientists involved in technological and scientific developments are constantly putting ethics and morals to the test. Yet scientists are often the last to be given the proper morals and ethics courses they need. The example of biological weapons development is a clear example.

The ethical systems developed within religion can provide the stepping stone to such an educational system. A system that has the potential to develop the needed international awareness. The key will be utilization of the two uniting principals of all religions: nonaggression and cooperation. The solution thus rests in the delivery of such an ethical system. Who better to perform such an act than the religious and spiritual leaders! There is a profound need to integrate the role of spiritual and religious leaders in the major decisions of biological warfare awareness.

The importance of religion in fostering international awareness is nothing new. The UNESCO Catalunya Center in Barcelona has organized several meetings on "The Contribution of Religions to the Culture of Peace." At the 1994 meeting, participants from all major religious groups issue the "Declaration on the Role of Religion in the Promotion of a Culture of Peace," identifying the need to unite all religions and cultural traditions.[132]

The recent stress given to bioethics committees is not unjustified. Bioethics committees are able to analyze scientific decisions from a multi-faceted approach, emphasizing the important ethical standards in question and give the necessary advice on these issues. These committees are traditionally made up of physicians, lawyers, scientists, and theologians. Emphasis on the development of bioethics committees dedicated to the threat of biological warfare may foster such a solution. Within the context of bioethics committees, religious and spiritual leaders will be able to take local awareness to an international level, emphasizing two of the most significant moral values that have been preserved throughout all religions: nonaggression and cooperation.

Efforts by international organizations to develop and preserve peace are increasing. The United Nations Educational, Scientific and Cultural Organization (UNESCO) has played an important role in formulating ethical principles, promoting ethical behavior, and establishing peaceful developments within the United Nations system. As a statement made at the 26th Session of the General Conference of UNESCO in 1991 explains, “Within the UN system, UNESCO has been entrusted with a special ethical mission in the promotion of a democratic culture that is conductive to the effective application of human rights and the establishment of a culture of peace.”[126] UNESCO’s Culture of Peace Programme is now gaining international recognition and support for their attempts to “ensure that the conflicts inherent in human relationships be resolved non-violently, based on the traditional values of peace.”[127] The Culture of Peace Programme is currently involved in national peacemaking programs throughout the world.

The recently established UNESCO Hebrew University International School for Molecular Biology and Microbiology (ISMBM), has combined the emphasis of peaceful negotiation with developments in science. The International School centers efforts on the implementation of “Science for Peace” through international cooperation in science. As Leah Boehm, chief scientist at Israel’s Science Ministry put it, “Science is less political than other issues, it’s a bridge for peace.”[128] The central issues of biological warfare fit perfectly into this bridge. The future of biological weapons development and research will depend on the outcome of ethical and moral responsibilities. An outcome that will be essential to both peace and science.

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The Origin of Life as the Emergence of a Planck-Like Quantum Distribution

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Biological explosion

The emergence of life is an autocatalytic phenomenon characterized by a phase transition in chemical reaction graphs. When the probability of catalysis is low, or the diversity of kinds of food molecules is low, or both, the generation of novel kinds of molecules soon dwindles to nothing. Behavior is “subcritical”. By contrast, when the probability of catalysis is sufficiently high, or the diversity is sufficiently high, or both, the system is “supracritical” and generates an “explosion of new kinds of molecules” that in turn catalyzes the formation of still further new kinds of molecules ad infinitum.

An example. Imagine that there are 10,000 kinds of organic molecules, that the chemical reactions are between “pairs” of organic molecules, that there are 1,000,000 kinds of antibody molecules and the probability that randomly chosen antibody molecules will catalyze randomly chosen reactions is something like “one in a billion”. Thus the expected number of reactions for which antibody catalysts are present in the system is the number of pair reactions, i.e. 10,000x10,000 = 100,000,000 times the number of antibody molecules divided by the probability that any given antibody molecule catalyzes any given reaction. The result is that the expected number of catalyzed reactions is

$$\text{FIRST ROUND, } \frac{10^8 x 10^6}{10^9} = 10^5$$

Once the system is ignited, it will keep “exploding in diversity”. In a second round, the number of potential pair reactions explodes as the square of 100,000 yielding 10 billion possible reactions. As before, the expected number of catalyzed reactions is now given by

$$\text{SECOND ROUND, } \frac{10^{10} x 10^6}{10^9} = 10^7$$

Thus in the second round of catalyzed reactions, about 10 million new molecular species will be created. The process continues, with the diversity of molecular species exploding fast. Behavior is supracritical.

“But life must control this explosion, or otherwise is destroyed!” In other words, the collectively autocatalytic processes underlying the emergence of life must be set “at the boundary of the above phase transition” (1)

But, which is the physical mechanism (if there is any) controlling such a phenomenon?

“In this work we guess that the underlying physical process is quantum, like the emergence of the Planck’s blackbody radiation distribution”: there is an analogy between the “explosion of the molecular species” and the “ultraviolet catastrophe” in the classical theory of the blackbody radiation!

QUANTUM MODEL

In order to formalize this view, we label any species of organic molecules by a (discrete) parameter v and assume that at the subcritical-supracritical boundary the collectively autocatalytic chemical reactions are “reversible”. In other words at the phase-transition boundary there exist two types of processes described by the graphics:

- Production:

$$\begin{array}{l} A \searrow \\ B \nearrow \end{array} p \rightarrow C' \tag{1}$$

- Absorption:

$$\begin{array}{l} A' \searrow \\ B' \nearrow \end{array} a \rightarrow C \tag{2}$$

where A, B, C, (A’ B’ C’) denote the organic molecules of the subcritical (supracritical) region in the space of the complex chemical reactions.

At this point one must assume some physical principle to constraint the interactions of type “p” and “a”. Following the statistical mechanics we assume the “principle of detailed balance” and the “principle of thermal equilibrium” [2]. The first principle requires that there are as many organic molecules absorbed as there are molecules created. The latter principle implies that the biosphere is in thermal equilibrium at the temperature T with the Universe.

Since we label the species of molecules by a parameter *v*, we denote by the quantity

$$v \rightarrow N(v) \tag{3}$$

the “number of species of type” v. Furthermore we associate to any autocatalytic reaction of type (1) and (2) a certain quantity of virtual chemical work

$$v \rightarrow \delta Q(v) \tag{4}$$

Our purpose is, in the following, to calculate the distribution N(v) by assuming the principles of detailed balance and thermal equilibrium.

Notice that until now we have not taken over any dinamical mechanism. We shall see that in order to avoid the explosion of the species, i.e that $N(v) \rightarrow \infty$ as $v \rightarrow \infty$, a quantum assumption must be done at the boundary of the interaction tasks (1) and (2). Namely, following Planck [3], we assume that at the boundary of the chemical phase transition the autocatalytic systems perform linked works according to "quantum mechanics laws". Therefore one has a probability for the creation of the species v, R (v), and a probability for the absorption of the species v, $R_a(v)$. By the analogy with the black-body radiation we set that

$$Rp\,(v;\, A + B \rightarrow C'_v)\ \alpha\ [N(v) + 1]\ I(v) \tag{5}$$

and

$$R_a\,(v; A' + B' \rightarrow C_v)\ \alpha\ N(v)I(v) \tag{6}$$

The form of the function $I(v)$ is not relevant here for our purposes. Furthermore it is reasonable to assume that $\delta Q(v)$ in Eq. (4) is an entire function of v which diverges as $v \rightarrow \infty$.

According now to the principe of detailed balance, one has that the number of molecules created at the subcritical-supracritical boundary must be equal to the number of molecules reabsorbed into the subcritical region, that is

$$N_{new}\, R_p = N_{old}\, R_a \tag{7}$$

By Eqs. (5-7) it follows that

$$\frac{N_{new}}{N_{old}} = \frac{R_a}{R_p} = \frac{N\ (v)}{N\ (v) + 1} \tag{8}$$

Furthermore, the hypothesis of thermal equilibrium (at a temperature T) of the biosphere with the Universe implies that the ratio N_{new}/N_{new} satisfies the Boltzaman law [2]

$$\frac{N_{new}}{N_{old}} = exp\ [-\ \delta Q\ (v)/kT] \tag{9}$$

Where *k* is the Boltzman constant. By setting Eq. (8) in (9) we get that

$$\frac{N(v)}{N(v) + 1} = exp\ [-\ \delta\, Q\ (v)\ /\ kT],$$

whose solution is given by the Planck-like distribution law

$$N(v) = 1/\ (exp\ [\delta\, Q\ (v)\ /\ kT] - 1) \tag{10}$$

Notice that even if $\delta Q(v) \sim \infty$ as $v \to \infty$, one has that $N(v) \sim 0$ in the same limit.

To summarize, we have shown that if the community of the "autonomous agents" performing the collectively autocatalytic reactions coordinates propagating works by "quantum jumps", then the number $N(v)$ of species v is given by the Planck-like distribution law (10). The more important consequence of this point of view is that the underlying quantum mechanism thresholds the dimensionality of the adjacent possible molecular species, so that one avoids the so-called "species catastrophe", formally characterized b the limit $N(v) \sim \infty$ as $v \sim \infty$.

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C. SCIENCE FOR PEACE IN THE MIDDLE EAST

Science for Peace

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It was, I think, Avempace or Averroes, but it could have easily been both, who said that once a seeker of knowledge reaches the epitome of his pursuit, then he or she could be said to have acquired a state of mind, or a state in the mind, which would render possible direct access to, and even mystical unison with the minds of other great men who reached such knowledge and who existed in the past. Having achieved such a state, these philosophers said, it would then be possible to interchange information or ideas with such men as Aristotle or Ptolemy -indeed, such interchange would assume the form almost of introspection, or of dialogue with the self. Time, space, culture, race, religion ... in short, all forms of diversity become shattered and fade away before this mystical meeting of minds.

These North African medieaval gentlemen, writing in supposedly less civilised times, actually saw in such meetings of minds, and in the epistemic state which renders such mental conferences or interfacing possible, happiness itself, the end-state of all human endeavor. Knowledge unites, not only between human beings, but also with the eternal mind itself, or with that reality which makes knowledge meaningful in the first place.

A debate nowadays rages across the Arabian Peninsula on the question of satellite dishes and the overwhelming number of “ideas” beaming through space and being indiscriminately received in the heart of religious and conservative private homes. Last month, in a workshop held at my university to discuss television and society, a similar debate was engendered concerning the merits of censorship in the context of fending off "dangerous ideas". Someone asked, Are ideas themselves dangerous ? One might as well fend off the world to a child, lest the child encounter danger. Surely, that person continued, what a country like ours requires is that we teach our children how best to cope with what exists out there in the world, rather than try to shut this world off altogether.

I mention Aristotle and Ptolemy in the same vein as television soap operas because somewhere behind the two references there is but one dilemma: it is the dilemma sketched in Professor Becker's statement, which I quickly read yesterday, concerning the question whether it is science which can function as an evil or the scientist. Clearly, science can be used for evil purposes. Almost anything- including the little mouse attached to my computer- can be so used. Thinking itself can be construed as a possible evil, or danger. I believe we all recall the early Bolshevik revolutionary later languishing in Stalin's jail, playing the tapping game on the wall in conversation with the prisoner in the next cell, as imagined in Arthur Koestler's "Darkness At Noon". Surely, it is sheer madness to try to shield communities from satellite transmissions, scientists from laboratories, readers from Lady Chaterley's Lover. On the contrary knowledge must be expanded constantly, as Averroes or Avempace might have argued, since it is in its expansion that human beings can realize their potentials.

But to sanction the pursuit of knowledge, or of science, by disclaiming any organic or inherent relationship it might have with evil is not thereby to relieve scientists from social and political responsibility. A scientist is not, and should not feel himself to be socially or politically neutral. No individual is an unencumbered, autonomous self subsisting in total abstraction or isolation of his surrounding enviornment, whatever he himself might feel. Being a human being automatically means being part of a larger order, and being a scientist in this larger order already determines responsibilities of being a scientist. We all remember the caveman / philosopher in Plato, and whom Plato has returning to the cave in order to function in the role he is most fit to function in, namely as a leader of men. Plato's philosopher / king is a human being who has sacrificed his own personal happiness or satisfaction as an armchair philosopher for the sake of leading the society of men in the right direction. In the Moslem milieu, Alfarabi's philosopher-king is depicted as someone whose true fulfillment or happiness cannot in any case be realized except through performing the function of leadership for which he is most fit. In both cases, all we need to understand by "leadership" is simply being socially conscientious, or having social presence. Perhaps we can find scientists like those described by Plato, and yet others like those described by Alfarabi, or scientists who, in other words, would respectively feel they are not being absolutely true to their scientific pursuits or they are most fulfilled and true to those pursuits as they each perform their leadership or social roles: but Plato or Alfarabi, it is clear in any case that scientists have a social / political role which they should not shirk.

This social / political duty, to return to Avempace and Averroes and to the beginning, is one which springs from a deep commitment to human destiny. It rests on the belief that as human beings become more powerful through their knowledge, they also come closer to each other. But then, conversely, as human beings and scientists among them come closer to each other, they develop their knowledge and power. Surely, this is a basic recipe for scientific cooperation. It is a basic recipe for scientific duty or responsibility. Time, space, culture, race, religion....all these become shattered and faded before this primary imperative: to seek knowledge, and to use it in order to further advance the human race towards fulfillment. Far more important than building bridges between businessmen or politicians is therefore the challenge of building bridges between scientists, and no more is this true than across the Palestinian / Israeli divide. This is a challenge because, next to being professionally excellent in science, scientists must also be made to achieve professional excellence as human beings. Clearly, a morally skewed scientist, like a morally skewed politician, can do far more damage to their surroundings than many a moral misfit coming from other kinds of professional backgrounds.

I cannot conclude without a word on the state of scientific cooperation, or of non-cooperation in the Israeli / Palestinian context. Why, if cooperation has such value, and its logic is unbeatable, do we not have Israeli and Palestinian academic institutions leading their respective societites towards mutual understanding through example. I will mention the cause, and a possible remedy. The cause, simply, is the non-existence of freedom of movement for Palestinian students and faculty in the Palestinian areas, and the prevention, as a result, of normal academic activities and access between the various Palestinian universities. Under such circumstances it is felt that it would be unnatural to establish "normal" activities with Israeli universities, students, or faculty. "Normalisation" of academic life on the Palestinian side of the divide is thus felt to be a prerequisite for normalisation of relations accross that divide.

Israeli universities are obviously not to blame for the situation in the Palestinian areas. It is not they who impose restrictions on movement, nor is it they who can order a lifting of such restrictions. But Israeli universities can at least express their solidarity, as places of learning and scientific pursuits, with their counterparts on the Palestinian side. Such an expression of solidarity would in any case be in place in the universe of academia. But its being voiced would surely encourage Palestinian universities to distinguish between Government measures and the Israeli academia, and it might well therefore act as that trigger which will allow bridges of cooperation to be built, as they should be, between Israeli and Palestinian universities.

Is the Middle East Ready for a Regional University?

Tel Aviv University, Israel, Avivi I. Yavin

1. Introduction

Mr. Chairman! I wish to start my presentation by thanking Professors Yechiel Becker, Joseph Shinar, and James Vary for organizing this important and timely symposium on the subject of the contribution of science to peace. I also thank them for inviting me to present my ideas concerning the establishment of a Middle East University in steps.

In 1994, A Palestinian physicist, Reyad Sawafta, and I wrote a proposal which we called: "The Red Sea Academic Institute", and distributed it among friends and other interested parties. Although there were a few skeptics, by and large, the proposal was met with warm reaction and encouragement to pursue it vigorously. Parts of that proposal appear in the Proceedings of a Conference on Science and Technology for Central America: Plans and Strategies, edited by J.P. Vary and G. Violini, San Salvador 1996. A summary of that proposal will now be outlined in the present manuscript. I hope that the presentation here will encourage discussions, and will interest people to join our effort.

There are several reasons for the great need for an open regional university in the Middle East.

a) **Distance and isolation.** In comparison with scientists in, say, Milano, Zurich, and Bonn, or in Ames and Chicago, the scientists in the various countries of the Middle East are hours away from the big scientific centers. Moreover, because of the political situation, they have been isolated, and therefore practically distant even from colleagues in neighboring countries.

b) **Absence of critical masses.** Few countries in the region have sufficient manpower to sustain front-line efforts in research, and often also insufficient number of university teachers of high standard, or large enough student body for such teachers.
c) **Imbalance.** While one country might lack a critical mass in one field, it might have a surplus in another, but due to the political situation, it cannot pull forces with neighboring countries.
d) **Brain drain.** These difficulties, along with the economic hardship and absence of internationally competitive industry are among the major factors causing the severe brain drain, or brain over-flow which the Middle East experiences. Hundreds, if not thousands of well qualified young scientists go to the developed world to study, and often stay there, depriving their own society and the whole region of the use of their own talents and expertise.
e) **Impossibility of meaningful research.** In some fields it is all but impossible to do meaningful research when the borders are closed. How can medical researchers protect the population of their country from an epidemic disease, if its source is in a neighboring country with whose scientists they cannot collaborate in research? Similar difficulties are faced by researchers of bird migration, agriculture, fish cultures, etc. Perhaps the greatest advantage of being in an open regional university is the opportunity to study, teach, and carry out research together with scientists from the whole region. Facing these challenges together is an excellent way to understanding one another, a pre-requisite for living in peace.

2. Previous Efforts

a) **A letter to Cairo.** My own attempts to start scientific collaborations between Arab and Israeli scientists started a long time ago. In 1975, as the Dean of the Faculty of Exact Sciences at Tel Aviv University, I wrote the Dean of Cairo University a letter, proposing that we start scientific collaborations between us, even though our politicians were not then "on talking terms", similarly to the way that the Russian-American scientific collaboration started years before the political detente. Neither my Government nor his were happy with my letter, and I received no response.

b) **The Research Project on Peace.** In 1978, soon after the arrival of Anwar Sadat in Jerusalem, we started a big all-departmental project at Tel Aviv University, called The Research Project on Peace. As the Project's first director I travelled to Egypt several times, attempting to establish multi-projects program of scientific cooperation. Although I was met with support in the scientific community, and had the personal interest and support of Dr. Boutros Boutros Ghali, the then Egyptian Minister of State for Foreign Affairs, the Governments involved did not give their official blessing, which then was crucial.

c) **The APS-EPS Mediterranean Conference.** My third attempt to start scientific collaboration was my proposal to the American Physical Society in 1986 to use its influence and organize a conference on Quarks and Nuclei in an island in the Eastern Mediterranean region, attended mostly by Arab and Israeli students, in which first rate scientists will lecture. Although the APS approved the program, it could not come to an agreement with the EPS, and without such an agreement the program came to a halt.

d) **Recent successful attempts.** As we all know, several groups have had some measure of success mostly in small projects, sometimes with the help of a group in a "neutral" country. The conference in Dahab, about a year ago, is such an example. There have also been cooperative programs in medicine, agriculture, as well as other fields. Although these are small and yet uncoordinated programs, they indicate that there is a growing interest to cooperate freely in the sciences and harvest the fruits of such a long overdue activity. The present symposium, which is organized with the blessed help of UNESCO, is a good indication that we are finally on the right track toward full and free scientific cooperation in the Middle-East region.

e) **The working group.** Following my talk at the San Salvador meeting I was approached by Professor James Vary who asked me simply: “How can I help?” This was a pleasant and welcome indication that the idea of a Middle East University has a strong appeal. And in fact, UNESCO-Paris then sent a mission to the Middle East, composed of Professor James Vary, Dr. Hildegard Vary, and Professor Galileo Violini. They met various scientific leaders in the region, and recommended to establish a major academic institute at the region. I myself have been in contact with such leaders in both Israel and neighboring countries, in an attempt to establish a high-level working group for the planning and development of the University.

3. A University in Steps

The whole program leading to the establishment of a full-fledge university is clearly up to the working group, which should be composed of presidents, deans and institution heads (or former ones) as well as senior scientists, mainly, but not exclusively, from the Middle East. We will not attempt here to pre-empt the working of this group, but only to point out a few major topics which it will have to tackle.

a) The various steps:
   - **Courses, summer schools, and conferences.** The first and relatively simple step can be the putting of as many of the smaller cooperative programs as possible under the same

roof, by establishing the infrastructure needed: simple housing, administration, etc. Existing as well as new programs are good candidates, if they so desire. By existing programs I mean courses, summer schools, periodic conferences, etc.

- **Colleges.** The first major new step will be the establishment of a new (junior) college. There exist several programs for colleges in the region, which will be open to Arab and Jews, and such programs could be coordinated and supported by the proposed program if they become part of the major plan.
- **A Research Institute.** The establishment of a research institute or several such institutes is a natural next step. Several such institutes in physics, astronomy, oceanography, microbiology, and others have been proposed recently, some on very high level. Again, coordination, and especially use of the same physical and administrative infra-structure, can be highly cost effective.
- **A University.** A full-fledge university, with undergraduate as well as graduate schools, and with the research institute(s) is clearly the final goal of the program. Without such a high-level educational institute it will be impossible to achieve full effect. For example, students, and even teachers in colleges are not always the most appropriate personnel for a high-level research, which requires university professors and graduate students. Clearly, the courses, summer schools, and periodic conferences could be housed at the University campus.

b) Students

Students are expected to come, first of all, from countries which are part of the peace process. At the moment this mainly means Egypt, Israel, Jordan, and the Palestinian Authority. Hopefully, they will also come from other countries in the Middle East or East Mediterranean such as Saudia, Sudan, Syria, Lebanon, Greece, Cyprus, and Turkey. The so-called diaspora is a promising source of Arab and Israeli st dents, many of whom are eager to return to the region and work and contribute to its development. If materialized, the process could be called “reverse brain drain”. The university will, clearly, be open to students from all over the world.

c) Faculty
It is expected that in the first stages of the plan, teaching will be carried out by professors who work full time at the new college / university as well as by professors from existing universities in the region, as part-time teachers. With time, the perce tage of full-time professors will increase. Even more than with students, the diaspora is expected to be the major source of professors and researchers. The university will be an open institution, and we also expect academicians with no Middle-East background to take part in its activities from the beginning. In fact, due to the unique character of this university, we expect scientist of high caliber, who usually do not come to young universities, to join this pioneering endeavor.

d) Disciplines
It is advisable to start with science and technology, and this for two major reasons: (a) the region needs science and technology to meet the modern challenges, and catch up with the lost time, and (b) science and technology are international, and by and large do not involve politics. Disciplines such as basic science, agriculture, medicine, water, energy, and desert studies will be among the first ones to be emphasized, depending somewhat on the available personnel and funding. For instance, if an interest develops to emphasize microbiology, and funds are available, this discipline can get priority in development. Semitic languages as well as Mid-Eastern culture and history will be introduced as early as possible, but carefully, to avoid getting involved in ideologies at an immature state of the University development. Teaching will be in English.

e) Location
An ideal location is one which is a meeting point of several countries, and in an attractive spot. Such a venue is the Aqaba-Eilat-Taba region, the meeting place of Jordan, Israel, and Egypt, and, with a great deal of attraction due to the Red Sea. It is also close to Saudia, the Sudan and other countries.The Jericho-Northern Dead Sea region is another possibility, as it is the meeting point of Jordan, Israel, and the Palestinian Authority, and is located a small distance from existing Jordanian, Israeli, and Palestinian academic institutions, which can provide teachers and laboratories, especially in the starting stages. Even if one of the locations is chosen, there is no reason why a second campus cannot be built in the second location, belonging to the same University system.

f) Supervision
UNESCO is, most likely, the international cultural organization best fit to launch the program and supervise it. It can do it either directly, or by delegating authority to an internationally known university in the region (Rome University as an example) or out of the region (a university such as Harvard or MIT). If UNESCO cannot provide the necessary leadership, the above mentioned universities can be approached directly, or some local universities such as the ones in Cairo, Amman, and Jerusalem can be approached. The decision on that, as well on the other items, will be made by the working group mentioned above.

4. Budgetary Estimates

It is difficult to give even a rough estimate of the budgetary needs for each stage of the program, as it depends on so many unknown factors. Still we can say that some seed money of about $ 100,000 will be needed for the activity of the working group, which should last about one year. A similar amount will be required for the design of the first 1-2 stages. The exact amount will depend greatly on whether existing or new plans for the college will be used. The design of the Institute, and of the University, at a later stage, will clearly require a great deal more, whereas a modest program (first stage) of courses, summer schools, and conferences will require $ 300,000 to $ 500,000 annually. Millions of dollars will be required annually for the College or the Institute for construction as well as for operation; while tens of millions of dollars will be required annually for the full-fledge University. Still the most critical sum is the $ 100,000 needed right away for the working group and for the beginning of planning. It is clear that appreciable funding cannot come from UNESCO, but it is expected that UNESCO would be a major factor in a campaign to raise the necessary funds. It is also hoped that UNESCO would contribute significantly, directly or indirectly, to the activity of the working group. There are three sources for funding that should be approached: participating countries (directly, or via existing universities), international organizations, and philantropists, who would be interested in supporting such an important and pioneering program. Personally, I would wish to see a consortium of Gulf countries and world Jewish organizations taking the lead together.

5. Is the Region Ready?

This is definitely an important question. My experience with the Research Project on Peace in the late seventies, and with the APS-EPS attempt ten years late to organize a Mediterranean conference has taught me that such endeavors should be attempted when the conditions are right, and should be proceeded with a great deal of vigor and tact. Also, although the peace process is moving forward, there are always ups and downs. It is important that the program will not depend on fluctuations in the political arena, but will proceed as much as possible, independently of such fluctuations. It is for this reason that I propose to pursue at this moment only the creation and activity of the working group, and to do it under the auspices of UNESCO. With the success of that activity, and with the political situation becoming clearer, the next steps, as recommended by the working group, can be pursued.

6. A Recent Encouraging Development

A very important development took place on my way to the symposium. On the invitation of UNESCO, I stopped over in Paris and talked with their personnel. I then met with the Assistant Director-General for Science, Professor Maurizio Iaccarino, as well as with some other high-level personnel in the Science Sector. Professor Iaccarino was very interested in the program; in fact, he stated several times that he was enthusiastic about it, and promised his personal help and the help of UNESCO. Specifically, he offered assistance in the formation of the working group, in enlisting the support of Nobel Laureates, in mustering the funds for the working group, and in supplying the needed UNESCO umbrella. As I said, this is very encouraging, and indicates strongly that we are on the right track.

MEFECSAT: A Regional University in the M.E., an Application Though Inter-Action

S. A. Romahi, Applied Science University, Jordan

Professor Becker,
Professor James Vazy, Professor Shinar
Distinguished Scholars, Ladies and Gentlemen,

I am delighted to receive an invitation to attend this conference that serves peace through sciences. Although I noticed that my colleagues come from the background of applied theoretical solid sciences, I felt the necessity of humanities experts participation too.

Signing peace treaties between warried parties has never been a goal by itself nor carries the weight of the noble target that it is hitting or looking for! Working on peace must be followed by inter-action. In the case of the M.E., we must see the new generations of the region mingle & play together, live & travel together, and learn to do research together. A regional university in the M.E. will be a best example. When I met with the distinguished scholar, Professor Becker, before the start of the conference, he encouraged me to present MEFECSAT that engulfs the regional M.E. University; together with its other projects related to human resources developments where students, learners, and scholars will live together without discrimination in any form under one ceiling in this region.

Ladies and Gentlemen,

I am glad to learn of this 2nd symposium on Science for Peace and that a special attention is being paid to this subject. As a matter of fact, relations between Science & Peace has not been thoroughly and intensively dealt with in an adequate manner. Neither it has been systematically formulated.

At best, there are more or less plausible assumption that a relationship does exsit. Before this can be dealt with further however, both terms “science” and “peace” should be defined. This presents no problem in the case of Science which may means progress, technology, and socio-economic reform. The definition of Peace, however, presents some difficulties. Assuming that the simple definition of “absence of war” is not sufficient, one could consider attempts from peace research, of which the following has proved to be the most useful. Peace may be understood as a procedural patterns of the international system which is marked by decreasing violence and increasing social justice. Thus defining peace may be used as an overriding norm against which the behaviour of individuals, groups or institutions can be measured.

The internationalisation of the experience with Science effects differentiation in the analysis of this problem within the intersocial or international context. This is especially true with regard to the traditional Peace research developing during the fifties until the mid-sixties. This is still observable, in the Discipline of international relations and in most of the studies in the field of military strategy. To a large extent this research may be labeled as cause-of-war research, and its take-off was very much determined by the catastrophic experiences during World War II.

The recent political dispute on a new international peace order has made this research concerning science-effects on creating peace inside societies, very relevant and salient. From the perspective of peace research as a discipline which encompasses various disciplines, a considerable gap in the analysis of science effects on peace-process has to be noted. This gap consists in the hitherto missing feed-back of already available results which so far have been coexisting with each other without necessarily being interlinked. Accordingly, the coordination of such results are missing on the one hand, while the initiation of a kind of research to which social science disciplines would make specific contributions not on the basis of their already existing particularistic expertise but from a more encompassing perspective. Such an encompassing perspective can, however, be developed only if “science effects on peace process” are considered as a socio-political phenomenon in their totality.

In a very superficial sense, such research would be interdisciplinary. ln reality, however, it has to be re-structured in a transdisclplinary way. The difference between interdisciplinary and transdisciplinary is a very considerable one. Interdisciplinary eventually means the adding up of analytical issues, precisely as interdisciplinary research groups have usually been added up with scientists from various individual disciplines and their particular expertise. In contrast to this, transdisciplinary means overtapping expertise of different disciplines focused on new problem definitions which convey to such research a new identity.

Science and technological developments today appear in a quite different perspective from that presented a hundred years ago. Modern technological development is aimed towards such topics as the world energy requirement, raw materials, environmental protection, the transfer of technical know-how to developing countries the breaking down of social barriers and the fulfilment of social needs. These objectives must form the future of social and international peace process. This means, there will be no peace without development. At the same time, “Permanent Peace“ is the future basis of development, which can be achieved through Science and technology.

A hundred years ago, scientists still had vast territories of untapped knowledge to explore, approached the problems of their time with modest resources measured by today's standards and researches. In our time, changes have occurred. Developments in engineering, nuclear sector, electronics, information processing technology and medicine are continuing to serve advance peace.

On the other hand, the imbalance of living standards between the highly industrialised nations and the developing countries which rapid technological development has brought with it not only confronts engineers with new tasks but also creates dangerous political tensions throughout the world. While the industrialised countries, with a population of about 1000 million consume nearly seven-eighths of the resources, the “third-world” with more than 2500 million people gets the remaining eighth.*

Observing the M.E. region since the signing the peace accord between the PLO & Israel in September 1993, peace process has been something of a “Roller Coaster” despite some set backs the handshake between Rabin & Arafat together with the Israeli-Jordanian Agreement are revolutionary steps. Both maintain a land mark and potential watershed in more than half a century-old conflict between Israel and her neighbours.

However, a great distance remains to marsh before achieving the genuine and workable peace we are looking for. It remains to be seen whether the gains that have been made will generate enough momentum to overcome obstacles that still lie ahead. Although peace we are looking for is not fully achieved, it is very possible. In both sides actions, the agreements have demonstrated that obstacles to peace are not instrumentable, and that both Arabs & Israelis can reach an accommodation if they possess the will to do so! Thereby, ending a dispute to many was unsolvable.

Dr. Pundak, one of the Oslo peace negotiators mentioned that despite what leaders and govermnents are signing, peace will “remain ineffective”, even there will be no peace unless certain actions will be taken. We must see that all workers, professionals of white and blue collars, & business men are working together; while teachers, professors, and students are mingling in an inter-actioning atmosphere; exchanged, and freely crossing the borders without hinderance. Red tapes in our dealings must be cut to the minimum to eliminate the psychological barriers between both parties.

In other words we have to transform our societies and our children's teaching from the culture of war to the culture of peace, as Prof. Forstenzer, one of our distinguished speakers, has referred to it in the UNESCO programme of “peace culture“. The introduction of the culture of peace in the UNESCO literature is a positive step, indeed.

Science for Peace, therefore, must become a part of our culture, development, and democracy. On the other hand, Israel's economic integration into the Middle East in the peace era is of major importance in the evolution of Arab- Israel relations. Emerging pattems of trade and commerce will lay a foundation for Israel's integration into the Middle East international system, and for the normalisation of its relations with the Arab States.

An impressive array of economic contacts have developed between Israel and a number of Arab States in the wake of the September 1993 accord. This suggests that most Arab countries do not have any independent grievances against Israel. They may agree that, a historic injustice was done to the Palestinians, but they have no desire to sacrifice the future in a futile effort to undo the past. If an accommodation acceptable to the Palestinians can be obtained, they are ready, to explore the possibility that it is to their own interest to develop economic relations with the Jewish State.

Thinking of the aftermath peace treaty developments, and expecting more in the future, many observers, accordingly, point to economic cooperation as the foundation for Israel's entry into the Middle East international system, especially with successful realisation of joint development projects. The benefits of economic cooperation thus involve more than economic considerations alone. It is significant in equal or even greater measures by virtue of its contribution to the normalisation of Israel-Arab relations. Economic linkages and cooperation venture will give each people proof of the other's good intentions, thereby contributing to the psychology of peace and accelerating its momentum.

Areas where cooperation development is possible does include tourism, agricultural projects, mutual and joint venture projects. Tourism may be attracted and encouraged by the stability that must accompany peace when jointly develop tourism infrastructure such as hotels, medical spas, & tourist complexes.

Agriculture is another area where cooperation is, particularly, likely. Developments in this sector will most likely extend beyond trade in agricultural products and technology. Possible or even probable, would be joint ventures in such areas as fishing, food processing, and canning. While such projects would probably in first instance involve Israelis, Palestinians, and Jordanians, they might very well, at later stages, draw upon capital form other Arab countries and seek to export to regional and international markets into the Arab world or elsewhere. They would also, in all probability, lay a foundation for govenrmental joint ventures.

Such exchanges with be of greatest value and will contribute most to a long-term stability if they represent inter-action among partners who are advantaged to comparable degree by their economic relationships. Competing propositions may again be advanced about how peace would affect the division between Arabs and Jews inside Israel.

On the positive side, it is obvious that a major source of tension between the two communities would be removed. Israel's Arab minority would no longer belong to a nation with which Jews are at war. This would introduce a tremendous psychological change into their inter-communal and inter-personal relations, eliminating the most important mistrust and tension between Israeli, Arabs and Jews. There would also be expanded and more normal relations between Israeli Jews and Palestinians and other Arabs in the neighbouring countries. which, in tum, would undermine Jewish stereo types about Arabs, and contribute further to improved relations inside Israel.

In addition, peace would reduce, or perhaps even eliminate, many of the barriers that limit Arab participation in important aspects of Israeli life, such as in the military service, or working in those fields of science and industry with military connections. Moreover, this would not only expand opportunities for Arabs and reduce some of their grievances about inequality and discrimination, it would also broaden the range of personal contacts between Arabs and Jews and intensify the psychological transformaton.

In the sector of education, one may think how cannot both (Arabs and Israelis) in this part of the world serve their glorious past, where, since time immemorial, this part of the world has been a cradle of civilisation, contributing to human heritage. The three monotheistic religions were born in this region. This land of honey, milk, and peace did not enjoy peace for a long time. Even after they got their independence, nations of this region witnessed three Arab Israeli wars. After living for more than forty years in this situation, they realised that it was time to enjoy the recently initiated peace to re-start and continue their contribution to man's civilisation and human heritage. The River Jordan has never been anything but a uniting factor for communities living on its both banks.

In the light of the new political atmosphere and the new sense of optimism that has emerged, we are offered a unique opportunity to work for the interests of all peoples in the region. Therefore, we have to contribute in the direction of solidifying and cementing the effectuation of this peace through development of manpower and human resources, in order to expedite pace of socio-economic development and regional prosperity that is becoming of vital interest to all peace loving nations and leaders.

Needless to say that a civilised world at peace will be realised only through education and we must seek to educate the future generations. Therefore, we must encourage the integration of human beings and to advance the realisation of world peace and understanding through international education.

It is an axium to say that the peace accords and peace agreements are not ends by themselves. They are mere signs to end the hot wars, and are signs to start greater struggles for peace, development, and progress, through fraternal work.

Prophet Mohammad, when he ended his wars, and signed treaties with the enfidels of Mecca, told his followers that “Now you just finished with the Smaller Jihad; But you are entering the new era of Greater Jihad.“ When asked the explanation, the Prophet stated that this means “self fighting, self denial and learning how to live in and develop, the new society of peace.“ In other words, this is what we presently term it as, “introducing the culture of peace.“

Sharing knowledge through education and higher education is one of the main factors in the peace culture. This factor places certain pressures on the formal education and higher educational institutions to play a renewed and recognised role in the scientific and technological areas of development and modernisation. Those pressures may widen the gap between ambitions and resources. This will result in an increasing need for initiatives to develop human resources in the direction of the culture of peace.

To foster such ideas and implement such thoughts and ambitions, a planning committee of a group of academicians thought of the creation of an institution for the implementation of the goals of what has been discussed. The establishment of the MEFECSAT, with a target of serving all peoples in the region during the new era, was introduced. The philosophy of the MEFECSAT projects is to act as Melting Pot for the new Israeli & Arab generations to build the “new generations of peace“, without prejudice or discrimination against nationality, race, religion, colour, or sex.

Accordingly, one of MEFECSAT's objectives is teaching those children who used to throw stones learn how to build them in collaboration with their peace partners, and to teach those who used to carry guns to shoot together with their sympathizers on both sides) how to replace such acts by holding the pen, the axe, or any of the developmental tools to serve build the new society. By doing so, we are, then, crystalising leadership for the peaceful M.E. facing the challenges lying ahead in the 21 st century. Facing the nations of the M.E., there are great challenges pertaining to manpower and human resources development; such as economic, socio-cultural, educational, and that of the peace culture.

It goes without saying that major responsibility to solve the new challenges will always lie in the hands of the nations of this region in their "new order." It is of vital importance, therefore, that authorities as well as all active organisations motivate themselves to be ready to address future challenges. As such, MEFECSAT can play a major role in the modernisation and development of the new nations potentials with its various units of universities of applied sciences, other specialised colleges, technical and vocational training centres, and institutions of higher learning.

Furthermore, meeting the requirements of the new Peace Era in the region would become possible only through national hard work and international cooperation and support. The success of this Peace Era shall heavily depend on the preserving of the political, social and economic stability in the region. Nations of the MiddIe East have great hopes in what peace can bring with it; for it will be nourished and sustained only when the people of the region reap its fruition and direct benefits of fraternity, progress and prosperity. To bring prosperity to their people, countries of the region have to reach an agreement for future fraternal cooperation in various aspects of life.

In order to effectuate peace as a concept, as a goal & target, it becomes a necessity to use science as a bridge for peace effectuation in the M.E.

It is easy to discuss theories, write essays, and sign treaties and agreements for peace, but it is dffficult to effectuate it in the mind of men without application in some workable plans. Such plans we think of are those listed in MEFECSAT such as the regional university for the M.E. and related joint institutions and centres for learning, training, and higher learning in this region.

The inter-action of the body of students of such institutions within the society will positively reflect on their way of life and their way of thinking. Accordingly, those institutions will act as a minaret of cross-cultural haven and thought in the region by directing their programmes towards the bringing up of students in such a way that they may learn from each other and of other's experiences when they are exposed to such atmospheres of multicultural environments. Thus the regional University for the M.E. administered by MEFECSAT will bring the East with its culture to inter-act with the West and its cultures in addition to Arabs & Israelis when those young generations meet and mingle.

Accordingly, one of MEFECSAT's main objectives is, the making of its projects as cross-cultural centres; in which it could bring together many factions of the world. As a symbol of the peace process, it will bring new cultural ideas and concepts that might prove very beneficial. To sum up the objectives of those MEFECSAT's institutional projects, it may be said:

1. To provide the region with well educated graduates in those fields required for sustainable development.
2. To establish educational institutions that will offer programmes responsive to the employment needs of the region in the new milleniunm;
3. To fill the void which presently exists in the private educational structure of the region by offering a high standard of educational excellence that is not tainted by concerns for generations profit from education;

4. To limit the brain drain upon the region created by talented students who do not return after completing their university studies abroad;
5. To provide an American higher education to students who would not have the financial resources to study in the U.S.A. or the U.K.
6. To provide an American education to students who do not wish to live in the U.S.A. or in the West.
7. To generate a sense of cultural and intellectual commitment among students and the staff,
8. To foster commitment based upon a sense of communal responsibility among the University's students and staff.

MEFECSAT's Application:

With such objectives in mind, MEFECSAT was born. Meeting with the distinguished scholar, James Vary, in 1994, the implementation of the idea took-off. At the end of his mission to the Middle East as an envoy to Iowa State University & UNESCO, Professor James Vary, recommended MEFECSAT to UNESCO. Accordingly, I was invited to go to Paris. The idea was accepted and encouraged by UNESCO officials and by officials of Iowa State University for Science & Technology as well. Therefore, two memorandums of intent and understanding were signed with IITAP.

The Director General of UNESCO, Professor Mayor, wrote to the speaker supporting and encouraging the project and so did Professor Siegbert Raither of UNESCO. Our main target remains to transform this concept from paper work to a workable plan by materialising its projects. Among its major units is the regional University in the Middle East (The American University for the Middle East (AUME) in Amman with a future hopes to have some branches in the West Bank, Jerusalem, Israel, & Egypt, and in Lebanon, after the peace agreements are signed at that end.

The Planning Committee, cooperating with IITAP is working very hard to achieve its goals and see its hopes come into a reality. Looking a head for the bright future of this New M.E. we see it as the most noble work for peace lovers and the New M.E. builders can achieve. On purpose, the tides MEFECSAT (Mid East Foundation for Education, Culture, Science & Technology) & the AUME (American University of the M.E.) are carefully chosen to reflect the educational spirit of those institutions, and the region they intend to serve. Attached to the AUME, there will be a model college town that may accommodate professors with their families and students of both sexes from the region will mingle in the new atmosphere of peace.

Science parks including medical, industrial and agricultural will be established and made to encourage students, and professors, and men of industry and researches of all walks of life to working together on a research basis in a an amicable fraternal atmosphere.

Conclusions:

In conclusion, I like to point out that needless to say that Research for peace will lead for development & progress. However, without fraternal cooperation among nations, we cannot gain the fruits of developmental peace.

We have to think of the preparation of the new generations and channel the impact of science rescearch for peace in the M.E. for the socio-economic & cultural development of the region.

In order to assess tendencies in the development of science and technology, one must accept the fact that science and technology are embedded in a politico-socio-economic framework and that a multitude of correlations are involved. The extraordinary rapid advances which began in the last quarter of the 19th century enabled man to use the powers of nature to his advantage and thus shape his way of life as never before. All at once undreamt-of possibilities were opened up to mankind to initiate economic growth and socio-economic progress as a fundamental factor for peace.

Sharing such development by all parties will necessary lessen tension and sensitivity. Applying this to the region, Isaac Rabin was the first to tackle this problem when he said that in order to lessen tension and effectuate peace, all concemed parties must pay attention to the development and the well being and lessen the imbalance of living standards of all peoples of the regions especially for the Palestinians.

Ladies and Gentlemen,

Before concluding my speech, I would like to extend a good hand and great thanks to the co-sponsors of this conference, UNESCO, ISU (IITAP), & HUJ with a special thanks to both Professor Becker & Professor Vary and all those who devoted their energy & time to the success of this conference.

From Al Azhar University of Gaza to the Hebrew University of Jerusalem

Abed Al Nasser A. Al Hawajri
Msc. program in Microbiology, Institute of Microbiology
Hebrew University, Hadassah Medical School
The Hebrew University of Jerusalem

Many persons talked about the complications that faced who worked on the scientific cooperation projects between Palestinian, Jordanian, and Israeli scientists. Yes, it is true, because of many different factors in Arabic, and Israeli society that decrease the chances of success for such projects. As a Palestenian student, I would like to give you and any one interested an idea about the situation in the occupational territories especially in Gaza, where I live.

Gaza strip is a small area which contains about 1.2 million people. Even though nearly each house contains at least one educated person that graduated from the university, changes toward new thoughts and modern society are still far away for several reasons.

I. Religion

It is very important factor that determines peoples behaviors and their thoughts, which sometimes are affected badly because of wrong interpretation of religion instructions by radicals and some uneducated persons who benefit of such situation.

II. Traditions

It is the second factor that determines the society life and actions, since they are inherited from fathers to their sons as they are without changes, sometimes they replace the religion, even sometimes they are more powerful than religion itself on people. These traditions are followed by all people more than the law.

III. The Bad Economic Situation

People, that most of their time are searching to survive with their children, have no time to think of a better future, and they blame the occupation for this dark life.

IV. The Isolation

The isolation of the occupational territories from the rest of the world by the Israeli military roles contribute in the stability of the Palestinian society especially in Gaza strip.

V. The Political Situation

Fortynine years of hatred and wars between the Palestinians and the Israelis will not be so easy to forget and, it also difficult on both sides to forgive each other.

Due to these facts to think about peaceful and scientific cooperation between the two people is great and very difficult, so much patience and creative thoughts are needed for the success of these such projects.

Now I would like to explain my case, which as I think is a good example that can inform you about what is really going on.

When I mentioned my interest to study in the Hebrew University of Jerusalem in front of my friends who are educated like me they supported my idea, but advised me not to mention it infront of other people in Gaza, since it is not acceptable to most of them. Silently I started to search for a chance to study in the Hebrew University, until I met Prof. Becker who promised to help me find a scholarship that would enable me to study in the Hebrew University of UNESCO.

My troubles started when Prof. Becker sent me the acceptance letter to the Hebrew University. Since I was working as teacher assistant in Biology department of AL AZHAR University, I needed the agreement of the department head to leave for my study in the Hebrew University. His agreement was connected to the agreement of the University president who when he heard about my case asked me to first get the agreement of Palestinian Authority. After one month of intensive callings I got the Palestinian Authority agreement, and later it was easy to get the university agreement.

Now every thing is OK, in Gaza, but I have to get permission from the Israeli side in order to pass from Gaza strip to Jerusalem. To get this permission it was not an easy job, it took me seven months to get the first one which was just for three days the thing that forced me each day to travel from Gaza to Jerusalem and return back to Gaza on the same day afraid that if I am late after seven o'clock, I will not get any new permission. This period was so difficult for me since I had left my job and each day I would call Prof. Becker to find a way to get the permission, and he in turn searching and calling to different sides but there was no answer, until once I got the telephone of HAMOKID which is a center for human rights in Jerusalem. I talked to them and to Prof. Becker about them, and he talked to them asking to help me getting a permission, in their turn they starting their connection until I got a permission for three months and I am allowed to live in Jerusalem, but I have to renew it every three months to be able to continue my study. Later with the aid of HAMOKID I managed to get an Israeli visa for one year hoping to be renewed as often as I needed to complete my study.

The most significant thing in these facts that I got the Palestinian agreement, the three months permission, and the Israeli visa just because my scholarship is from the UNESCO support, nevertheless I would not get nothing. So I think without the involvement of international institutions in the cooperation projects their chances to succeed is low.

Finally I want to thank every one very helped me to make my dream come true especially Prof. Becker for his great efforts and support. I hope my experiment will be useful to any person who is thinking of making bridges between Palestinian and Israeli people. Lets give peace chance.

Thank you very much.

Towards a Commensalistic Relationship in Joint Israeli Palestinian Scientific Research

Jad Isaac
Director General Applied Research Institute-Jerusalem

I would like to thank the organizers for granting me the opportunity to address such a distinguished audience. I will begin by asserting that my address today, which represents my own personal view, comes from my deep belief in the role of scientists and scientific exchange in the peace process. I apologize to my fellow biologists for borrowing some terminologies on intra-species relationships in my analysis of the relationship between Palestinian and Israeli scientists.

Following the Israeli occupation of the West Bank and Gaza Strip, the relationship between Israelis and Palestinians turned into a symbiotic one (i.e. living together). In the first years of occupation, it was a sort of pseudo-symbiotic relationship, since both communities lived separately with very little interaction. But gradually, interactions increased as Israel started slowly incorporating Palestinians as a source of cheap labor for a growing Israeli economy. At the same time, there were some attempts by the Israeli Military Authorities to promote economic development in the Occupied Palestinian Territories. However, these came to a halt in the mid-1970s and the West Bank and Gaza have experienced a steady deterioration of services ever since. This is exemplified by the 1985 Meron Benevinisti report that the annual budget allocated by the Israeli Civil Administration for agricultural research in the entire West Bank was only $1,400.

Under prolonged Israeli occupation of Palestine, each side viewed the other in the form of stereotypes. Palestinians tended to see Israelis only as occupiers, who would confiscate their land, demolish their homes, arrest and kill their children and close their schools and universities. At the same time, Israelis viewed Palestinians as either workers doing menial jobs in Israel or as “terrorists”. Only in the business community were some real relationships of mutualism developed in which both Palestinian and Israeli business people benefitted. The scientific community on both sides played an indifferent role.

In 1973, two Palestinian Universities were established with funding from the PLO and international sources. In the following years, more universities were established to meet the growing demand as a result of admission restrictions for Palestinian students outside Palestine. However, due to competition for human and other resources, management needs and the increased demand for enrollment, the Palestinian universities were unable to put great amounts of effort into research, though there were, of course, individual exceptions.

The first contacts between Israeli and Palestinian academicians started in the mid-70’s with issues of academic freedom, through the solidarity committees that were formed in reaction to Israeli crackdowns on Palestinian universities. Israeli Arabs joined Palestinian universities as teaching faculty, but almost no attempts were made to promote scientific research between Israeli and Palestinian scientists.

The start of the Palestinian intifada, in 1987, led to new contacts between Israelis and Palestinians, specifically on the issues of human rights. Things changed in 1988 with the Palestinian Declaration of Independence, and the realization by both sides that a peaceful settlement was inevitable. At this stage, a wave of joint Israeli-Palestinian meetings took place, most significantly the roundtable discussione held by the Israeli-Palestinian Cooperative Research Institute (IPCRI). In these discussions, positions were presented and debated on issues such as water, environment, refugees, and Jerusalem. Internationally, more and more meetings were also taking place in specialized forums sponsored by international institutes concemed with science.

When the Madrid process began, direct negotiations between Israelis and Palestinians were accelerated. In general, the PLO asked Palestinian scientists to participate in both multi-lateral and bi-lateral negotiations. Many of the same Palestinians who had been active members of the Israeli-Palestinian dialogue groups were active either in the negotiations themselves, or in the technical committees supporting the negotiations. On the other hand, few of the Israelis who had participated in the roundtable discussions were present in the negotiations. This dichotomy led to suspicions by Palestinians that these scientific dialogues were being manipulated so that Israelis knew the Palestinian negotiating position prior to negotiations. This in turn led to diminishing participation in the dialogue groups.

The signing of the Oslo Agreement led to growing interest in joint work and more regular cooperation. Several joint Israeli-Palestinian projects were launched, though these were not hard core scientific research, but rather studies. Except for a few pioneers, the scientific community has remained for the most part dormant in fostering authentic scientific research.

I apologize for the harshness. I realize that it is unfair to many who have done their best to broach scientific cooperation between the two. However, I strongly believe that science and cooperation between scientists must play a more active role in peace in this region.

A prerequisite for sustainable peace in the Middle East is to have sustainable economies and governments. The transition to self rule and increasing responsibility will not be an easy one for the Palestinians. For the past twenty-eight years, a parasitic economic relationship existed between Israel and the OPT. The current trends of domineering and exploitation should come to an end. This means that the agricultural, industrial and services sectors will have to go through a process of transformation. Palestinians have to restructure their economy to meet the current and future challenges. The real challenge for our decision makers is how to provide food, clothing, shelter, health care, education, employment and security to our people under the existing conditions, without destroying the environment or depleting the resource base upon which the development process depends.

Palestinians in the West Bank and Gaza have few natural resources to make this happen. They must count on human resources, which will mean research and development will be a necessity. R&D however, requires capital equipment, resources and support, all of which Israel has. It is for this reason that I believe that Israelis who are true supporters of the peace process should do the utmost to promote Palestinian scientific research. Without it, the Palestinian economy cannot develop, and support for the peace process will wane.

This promotion of Palestinian research may not be of the greatest scientific value to Israeli scientists however, as they would be in the role of simply helping with the supply of resources and sidus, while not receiving greatly useful products in return. This is why I believe that the relationship to be developed should be commensalistic (in which one side benefits while the other is neither harmed nor benefits). This must be the case at least for the short term, where emphasis should be on capacity building for Palestinian scientific research institutions.

For this to happen, there are a number of prerequisites that must take place:

1) Israel and the PNA must cooperate to allow researchers to move freely and work together in training and capacity building activities.
2) Restrictions on all non-military data should be lifted.
3) Israeli services should be open for Palestinian use at reason-

able rates.

4) A Middle East scientific network should be established on e-mail, to facilitate exchanges of information and announcements of meetings and conferences.
5) A scientific journal covering Middle Eastern science issues could also be established and published on a regular basis.
6) Donor countries should support more scientific research, specifically committing 2% of their funding to scientific research in Palestine.
7) And the broader international community should lift constraints placed on Palestinian participation in appropriate international bodies such as the Food and Agriculture Organization (FAO), the International Plant Genetic Resources Institute (IPGRI), the World Health Organization (WHO), the Global Environment Facility (GEF), and the World Meteorological Organization (WMO).

I believe what I have presented here is the beginning of a recipe for success in building longterm regional scientific cooperation. In conclusion, I will just say I hope that in the next meeting I can present about how scientific cooperation could move from a commensalistic to a mutualistic relationship.

Thank you.

The Science of Coexistence

Alan B. Slifka
Chairman of the Board and Co-Founder of the Abraham Fund

Good afternoon. I am delighted to have been asked to speak to you, and it is a pleasure to be here.

The focus of my presentation today is the desirability for science to become more interested in the science of "coexistence." My thesis is that science appears to have been more interested in the science of "existence." Indeed, the behavioral sciences – anthropology, sociology, psychology, political science, and, more recently, sociobiology and evolutionary psychology – have been profoundly interested in human existence.

We know that humans like to live among their own kind – in community – within sub-communities of tribes, religions, nationalities, ethnicities of all kinds. In the United States, Arthur Schlessinger recently observed and wrote about "The Disuniting of America," that is, the tendency for Afro-Americans, Native Americans, and Hispanic Americans to want to preserve roots while living in a country epitomizing the melting pot. We know that diversity is a treasure and that homogeneity of peoplehood may be desirable to some, but that retention of communities with shared roots and values is desirable to others.

As the world's population increases, certain issues become more important, such as how to live among each other, how to coexist with "others," how to talk about coexistence, how to develop the vocabulary of coexistence, how to think about the philosophy of coexistence, and how to educate our young people about coexistence. Implicit in much of the need to understand the issues of coexistence – political, social, societal, psychological, educational – are the underlying, scientific issues of our innate, human condition, and how that plays out with sameness and difference and our ability to coexist.

Are people inherently good or bad? How does self-interest influence our shared and disparate goals? How much do we know about our moral equipment, our misuse of it, and our ignorance of whether we can learn to better coexist, and if so, how? Surely science and scientists can provide important answers regarding the most fundamental of contexts: how people can live better with people. In fact, now that we have been devoting scientific resources to enabling people to better coexist environmentally with nature, is it not time to devote scientific resources to enabling people to better coexist with people of difference? We have spent much effort learning about humans living in community. Perhaps it would be useful to spend more effort learning how to facilitate the sharing of communal space by disparate communities, that is, how to coexist.

As a co-founder of The Abraham Fund, I have been dealing with the issue of coexistence for ten years, seriously studying and furthering those activities which contribute to majority and minority living together better within a nation-state, specifically, Jewish and Arab citizens within Israel. We established The Abraham Fund to further coexistence activities in Israel, specifically, to assist those entities, organizations, and institutions in Israel which were providing various kinds of coexistence projects and programs.

What kinds of projects do we fund? Since humans don't coexist naturally, most of us need to be educated about coexistence. This education is both experiential and academic, as are the programs we support.

Experientially, Arabs and Jews come together for many different types of activities which occur in schools ranging from kindergarten to university, in community and cultural centers, in hospitals and clinics, in social service settings, and in businesses. We believe that shared activity in shared space with a common goal leads to a gradual dissipation of long-held stereotypes and prejudice among the participants.

In addition to coexistence activities, education for coexistence must take place inside the classroom. We have been diligently supporting programs engaged in this effort across the academic spectrum. Much more needs to be done, in terms of developing public policy for coexistence education; coexistence departments in colleges; teacher training programs; varied, age-appropriate teaching materials and media products, etc.

Even though there is much more to be done, coexistence has already become an issue of increasing importance and value within Israeli society. This country has developed such professional and programmatic expertise in this area that its coexistence projects are being looked at as models by other nations which are struggling with majority-minority conflict.

There is not consensus on the way that the word "coexistence" is defined or understood. The term "coexistence" seemed to The Abraham Fund's other co-founder, Eugene Weiner, to be the least demanding, most minimal way that people of difference might live adjacent to or among people of difference. The word implies a cool, distant acceptance. Perhaps it is the first, tiny step toward loving one's neighbor, which may be too much to ask both in the near and long term. After all, when dealing with traditional societies like those of the Jews and the Arabs, the most traditional frown on intermarriage; loving each other is not acceptable, and, in some cases, is punishable by death.

However, Yitzhak Navon, The Abraham Fund's esteemed and wise Board Member, Chairman of The Abraham Fund Israel Public Council, and former President of Israel, observes that "coexistence" needs to be combined with some modifier to represent a more useful goal. One may think of modifiers like "constructive," "friendly," "neighborly," "communal," "civil" as being helpful, but not too alarming, as a goal.

"Coexistence" has heretofore not been widely known as a useful term. To some, it is reminiscent of the Cold War. Others still think of peace as the objective. Many think in terms of the tools of problem-solving or methodologies, such as conflict resolution, mediation, or diversity training.

Yet the fundamental goal implicit in peace, or interpersonal methods, is community development. Community development, depending on the scale, inevitably gets larger than just the building of one specific, tiny community. It gradually evolves to the more difficult goal of building a community containing other communities. The challenge of a majority and a minority, often differing in religion, within a democracy or nation is how to best develop a city with a non-homogeneous population. Nation-building is inevitably a matter of facilitating coexistence. The question is whether science can increasingly be brought to bear.

It seems that there are many areas within the broad rubric of science which can make a contribution to the science of coexistence. Some of these are as follows:

- Science of Nature and Evolution
- Darwinism, Social Instincts, and the Biology of Survival
- Game Theory and Reciprocal Altruism
- The Science of Equality, Politics, Group Rights
- Scientific Education for Reciprocity; The Special Rights
- Interspecies: Whales, Apes, Humans
- Behavior Modification
- Neuroscience of Behavior
- Health Science
- Population Studies
- Psychology
- Anthropology
- Sociology
- Sex and Gender Studies
- Philosophy of Science

- Ethics and Science
- Geography
- Urban Design and Architecture

Just as the environment has become a global context in the last half century, I fervently believe that coexistence must become the most significant global context as we move into the twenty-first century. For without coexistence, there can be no existence.

As an environmentally concerned person, I am impressed with the many accomplishments that you and your fellow scientists have made in the field of the environment, such as the exploration and protection of natural sites, natural habitats, wildlife, and endangered species; innovations in agricultural, industrial, and technological techniques to improve the quality of the air we breathe, the water we drink, and the food we eat; advances in utilizing natural, environmental elements to promote health and longevity; forays into outer space and studies of planetary environments, etc.

I believe that now is the time to turn your manifold skills and talents to the quest for enhancing coexistence, so that "man's inhumanity to man," borne of ignorance, fear, distrust, and hate will become relegated to the past. I hope that we will enter the next century with a resolve to devote our heads and hearts to building cities, states, nations, and, indeed, a world, in which diverse populations coexist peacefully, side by side. These many, different populations will be proud of their own identities, cherish their own folkways and mores, and celebrate their own uniqueness. At the same time, they will accept, respect, and tolerate their neighbors, as distinct and different as they can be, all coexisting together as part of a larger, encompassing community.

Only if we join in a concerted effort to enhance coexistence in this way, can we all look forward to a sustainable future.

TAHRP: Five Years of Trilateral Animal Health Research Project

A. Shimshony

Recent events in the Middle East have created a favorable climate for greater cooperation among countries of the region to address problems of common interest. Within the past few years, noteworthy cooperation has occurred both within and parallel to the Peace Process, especially between Egypt and Israel. With support from the Middle East Regional Cooperative Project (MERC) of the US Agency for International Development (AID), beneficial cooperation has been achieved in projects related to wastewater management, human health and tropical diseases, salinity control, animal health and many others.

One of the more successful projects supported in the MERC has been the Trinational Animal Health Research Project (TAHRP), which was a cooperative effort between Israel and Egypt to develop information and technology needed for the effective control of three important animal diseases. The Middle East is internationally recognised as heavily and permanently stricken by contagious animal diseases, affecting livestock and humans, and endangering neighbouring regions such as Europe.

Egypt and Israel have both intensive and traditional forms of animal husbandry. With the intensification of livestock husbandry and the intimate contact with traditional production systems, animal disease hazards have increased. Modern animal breeds have little or no natural defense against endemic diseases and parasites and therefore require that greater disease preventative measures be taken.

The five-year project has been actively underway since early 1991, with a life-of-project budget of 3.4 million dollars. TAHRP was administered by the USDA. Its coordinators in Egypt and Israel were the respective Chief Veterinary Officers. The project involved State Veterinary Research Institutes in both countries and in the USA, as well as the Cairo and the Hebrew Universities. The collaborating US scientists came from the veterinary schools of California, Iowa and Texas. The initiative involved the development of information and technology for the control of Brucellosis, Foot and Mouth and Neonatal diseases. These diseases have a major effect on the Middle Eastern agricultural economies and one of them, Brucellosis, is a major public health problem as well.

The achievements of the three sub-projects were externally evaluated by two expert teams who carried out mid-term and final evaluations for AIDS Regarding Brucellosis, as a result of TAHRP's activities, there has been a considerable expansion of improved Brucellosis vaccination campaigns in Egypt and Israel. Central Brucellosis reference laboratories have been established for rapid identification and biovar typing. New field diagnostic techniques have been developed. The initiative has also led to the conclusion that Brucella melitensis, rather than Brucella abortus, is the main cause of brucellosis in bovines in the region.

In the field of Foot and Mouth disease research, the TARHP activities have resulted in the development of improved, rapid diagnostic procedures using PCR technology; the isolation, typing and molecular characterization of FMD virus in domestic animals and wildlife; obtaining information on the role of langerhans cells in the dynamics of FMD infections and immune response; and the implementation of improved vaccination campaigns. New information was collected on the role of wildlife in the region's FMD epidemiology, including experimental infection trials in wild boars and the study of their potential as FMD virus disseminators.

Refering to Neonatal Diseases in Cattle and Buffalo, TAHRP has been able to identify the major disease agents, both viral and bacterial, and implement vaccines to reduce mortality in participating herds in Egypt and Israel. Recent work was focused on molecular and serological identification of local strains of the principal disease causative organisms in an effort to further improve vaccine effectiveness.

Aside from the scientific and economic impact of these projects - and these were substantial - the most significant accomplishment has been the establishment of true cooperation between the two countries. From the start of the project, Egyptian and Israeli scientists have collaborated extensively in both laboratory and field work. There have been frequent exchange visits of scientists, sharing of technical procedures and experience, joint publications, training sessions, annual symposia and workshops. Considerable interest in the project has been generated among scientists in other countries of the region and broader participation in regional research and disease control programs is being discussed.

It was at the suggestion of the Egyptian Chief Veterinary Officer, Prof. Moussa, that the project's first Symposium was held in Tel Aviv in April 1992, with fifteen Egyptian scientists attending and presenting papers. In addition, several Palestinian veterinarians working in the Civil Administration for the West Bank and Gaza Strip attended the first symposium. The second symposium was held in Alexandria, Egypt in June 1993, the third in Sharm-el-Sheikh, Egypt in April 1994, and the fourth and final one in Tiberias, Israel in April 1995.

The third symposium, in Sharm-el-Sheikh, was co-sponsored as a Multilateral Peace Process activity, and was attended by project researchers and by experts from the West Bank and Gaza, Tunisia, Mauritania, Bahrain, Oman, Kuwait, Turkey and Saudi Arabia, the United States, and several European countries, as well as representatives of the WHO, EU, FAO and OIE. The last symposium, in Tiberias, was scientifically organized by Prof. Kalman Perk from the Hebrew University's Koret Veterinary School and Prof. Mohamad Refai from the Cairo University's Faculty of Veterinary Medicine, both TAHRP's Steering Committee members. In addition to TAHRP members, it hosted the Chief Veterinary Officers of Jordan and the Palestinian Authority, U.S., Palestinian and European experts, and representatives of USAID, EU, FAO, WHO, and OIE. The Egyptian delegation, comprising of twenty-five participants, was headed by Prof. Ali Moussa, Chief Veterinary Officer and President of the Egyptian Veterinary Medical Association. On the last day of this conference a plenary session on Animal Health in the Middle East and Opportunities for Cooperation was held in the Gabriel House in Zemach. It included contributions of the Palestinians, Jordanians and four international organizations who expressed strong support for the extention of the project.

Cooperation in the field of Animal Health is traditionally regarded essential by the international community; since epizootics cannot be controlled on the national level. One of the first intergovernmental organizations to be established after World War I was the OIE - Office International des Epizooties - the World Organization for Animal Health created in Paris by international agreement in January 1924. Its main objective is to obtain information on the occurrence and course of diseases of animals throughout the world, to disseminate it to all member countries, to propose ways of controlling them, and to provide coordination at the international level for studies devoted to the surveillance and control of animal diseases. Egypt was one of the twenty-seven founder states; Israel joined in 1949. Today OIE includes one hundred forty-three member states.

During April 1995, the Director General of the OIE, Dr. Jean Blancou, paid his first visit to Israel. His conclusions were included in his letter of 19 April, from which I cite:

> "In view of developments in the general situation in the region, and the need to strengthen animal disease surveillance and control

in the countries of the region, several lines of collaboration would seem worth pursuing.

An excellent research project in this field already exists: the 'Trinational Animal Health Research Project' (TAHRP) established between Egypt, Israel and the USA. This project aims to enhance and promote veterinary research between Egypt and Israel; to improve animal health and the control of animal diseases in both countries; and to generate novel diagnostic methods and control measures. The OIE is ready to actively participate in this project by sending experts, organizing scientific meetings, exchanging scientific documentation and material, etc. This project could be extended to include other countries in the region which want to participate."

Previously this year, on September 6th, the Chief Veterinary Officers of Egypt, Israel, Jordan and the Palestinian Authority met in Cairo and established a Regional Overview Committee (ROC) which will manage future common animal health research and control projects. As stated in the signed document, the initiative is based upon the successful and beneficial cooperation achieved by TAHRP between Egypt and Israel. The ROC will be flexible to add other regional parties if and when agreed upon. A proposal for a project named "Strengthening Regional Collaboration in Animal Disease and Zoonoses Control in the Middle East" has been forwarded by ROC to the USAID; the European Union is currently carrying out feasibility studies of other candidate regional veterinary projects.

The UNESCO - Hebrew University "Science for Peace" symposium is a significant step in the same direction. The development and application of novel biotechnological techniques are essential part of current disease control programs. The International School for Molecular Biology and Microbiology may play a significant role in this respect, following the footsteps of Department of Molecular Viorology in the Hebrew University, which participated in the FMD project of TAHRP.

I wish Prof. Yechiel Becker and the International School the best of success and use this opportunity to thank him for his significant contribution to the success of TAHRP.

Last month, the Israel Postal Authority has issued a new post stamp to celebrate the 75th anniversary of the Israeli State Veterinary Services. On the day-of-issue envelope they printed the words said by Jacob to his father-in-law, Laban:

“Your ewes and your she-goats have not miscarried” (Genesis 31, 38). Regional research and animal disease control will, hopefully, enhance the realization of Jacob’s words in the regional context and will add other species - including the human race - to the beneficiaries.

A Proposal for a Middle East Regional Scientific Cooperation Network Based on the Research Programme on Animal Virus Diseases by the European Economical Community (EEC) in the period 1971-1984

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Summary

The research projects developed by EEC DG - VI (Agriculture) during the period 1971-1984 were designed to develop collaborative research teams involving virologists from the nine EEC member states, Spain and Portugal, to combat the swine virus diseases which endangered the food resources in these countries. Two viruses were the subject of the research activities: 1) Classical Swine Fever virus which was endemic in the EEC states and 2) African Swine Fever virus which affected swine in Iberia and threatened to spread to neighboring countries. This research programme developed into a large scale research activity on additional viruses which endangered food

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animals and led to scientific cooperations among virologists from many institutions and universities in the EEC states. The budget of the research programme was provided by the central council of agricultural research in the EEC DGVI. The scientific collaborations in research (African and Classical Swine Fevers, bovine leukosis in cattle and other virus diseases) and strengthened the EEC, benefited the farmers and to the strengthening of the national virology laboratories. The goal of the participating virologists and immunologists was to solve the problems in the field and to advance the EEC by strengthening its economical capability. The advice given by the scientists improved virus legislation and protected the EEC member states from the importation of virus infected animals. Due to the legislation it was possible for EEC administration to plan the eradication of cattle infected with bovine leukosis virus (BLV) with compensation to the farmers paid from the EEC budget. Although the research on virus diseases in the EEC was just one of the many aspects which helped the transition from a European Economical Community into a European Union (EU), the virus research projects can be taken as an example that scientific cooperation among scientists from different countries that were involved in conflicts can build a bridge of understanding between nations to attain a goal beneficial to all the participating member EEC states.

Although the situation in the Middle East today markedly differs from the situation prevailing in the EEC (which was initiated in 1962) during the period of 1971-1984, it is suggested that scientific cooperation on viral and microbial diseases of humans, animals, fish, and plants, among the four parties to the peace agreements in the Middle East, may serve as a bridge for understanding and regional cooperation. In the absence of a regional central organization in the Middle East with financial backing, the UNESCO-Hebrew University of Jerusalem (HUJ) International School for Molecular Biology and Microbiology, (ISMBM) with the motto “Science for Peace”, undertook the first steps to reach the goal of building a Middle East Regional Scientific Cooperation Network of laboratories dealing with virus and microbial diseases. The Eilat Statement on Science for Peace and the Need to Develop a Middle East Regional Scientific Network (March 1997) provides the plan for establishment of the Network for the benefit of all the peoples in the region (Appendix I).

Introduction

One of the steps that contributed to the transition of the European Economical Community (EEC) into the European Union was a series of research projects on virus diseases of economically important farm animals. These research projects on African swine fever and classical swine fever were followed by a project on bovine leukosis that led to eradication of infected animals in the nine EEC member states with compensations to the farmers by EEC budget. These and other projects were organized by EEC Directorate VI Agriculture and was supervised by the Council on Agricultural Research. In 1984 the research support to the projects on virus diseases was stopped and only coordination of scientific meetings was possible since DG XII Science was established by EEC Brussels. During the research on virus diseases (1971-1984) a network of laboratories was established and the coordination of research efforts led to an improved understanding and collaboration among scientists from the nine EEC member states as well as Spain and Portugal. Scientists from the latter countries participated in the EEC projects in an attempt to halt the spread of African Swine Fever virus to the EEC member states. The members of the networks in the EEC research programme on virus diseases developed collaborative research activities with the understanding that the results of the research may help to strengthen the EEC member states by developing diagnostic tools for early detection of the virus diseases. For example, the development of an EEC diagnostic test for BLV by the research team led to cooperation between the scientist and the Agricultural EEC Legislation Department in Brussels. Member states required importation of BLV free cattle with a certificate that each animal was tested with the EEC BLV test. The immediate result was cessation of importation of infected cattle. At this stage it was possible to plan the removal of BLV infected cattle from all herds in the EEC with full compensation by EEC budget to the farmers. This led to a marked economical benefit to EEC member states with direct benefit to the EEC farmer.

My experience as the scientific adviser to the EEC program on virus diseases (1971-1984) and my involvement in the development of the virus research networks in the programme convinced me that such an approach may be beneficial if developed in the Middle East and Neighboring Countries. The comparison to the developments in the EEC is not possible since (as yet) there is no Regional Agreement to develop a Middle East Economical Community (MEEC) although four parties in the Middle East are involved in Peace Agreements and a peace process. To support the regional peace we need to develop a virus diagnostic network of laboratories in the four parties that will cooperate on the eradication of virus diseases of humans, animals, fish and plants. This is essential for the peoples of the Middle East since viruses do not recognize man made borders. Such a Network for Scientific Cooperation in the Middle East may help to enhance understanding and will bring immediate benefits to the populations of the Middle East countries and will enhance the peace process in the region.

This presentation provides the conceptual approaches to the development of a Middle East Regional Scientific Cooperation Network based on the success of the EEC programme of animal viruses. Such a Network would protect human health and food resources of the Middle East Region and enhance the understanding that scientific research cooperation and peace will benefit all the people in the region. In section A and B the experiences from the EEC virus programmes will be described, in Section C the idea of the Middle East Regional Scientific Network will described, and in Section D the Eilat Statement of Science for Peace and the plan to establish the Scientific Network will be presented.

A. Approaches to Enhance Scientific Cooperation during the Second Swine Fever Project for the Period: 1971-1976 coordinated by EEC Directorate General VI Agriculture.

My first encounter with the EEC swine fevers research project was in a workshop in Lisbon, Portugal, in 1971 where the results of the first swine fever project were evaluated. At the workshop I met Mr. Raymond Craps, the mastermind of the project, and was enlisted by him to be the scientific advisor to this research programme. As a result of the 1971 meeting in Lisbon and the evaluation of the previous 5 years of the swine fever research, it was clear to us that the scientific workshops on swine fevers should involve the bench level virologists from all the participating institutes or laboratories as well as virologists from outside the EEC who research viruses. Before starting the planning and organization of additional workshops it was necessary to visit all the EEC supported laboratories to meet the scientists at their work places, to learn of their research activities, to evaluate the level, equipment and the technologies used and to discuss the research plans with each laboratory team. The research on ASFV was done in the National Veterinary Institutes in Lisbon and Madrid since ASFV was endogenous in pigs and widely spread in the domestic swine herds and in wild swine herds. Outside Iberia, only the Animal Virus Research Institute in Pirbright, England, with its biological safety laboratories for ASFV research in swine, was allowed by the EEC Council on Agriculture Research to participate in the ASFV project. All other EEC laboratories in the programme researched the classical swine fever virus (CSFV) and pig immunology. Seventeen EEC laboratories participated in the ASFV and CSFV research programme during the period 1971-1976.

To evaluate the state of research on the porcine virus diseases reached by the scientists in the participating laboratories site visits were performed. It was possible to note that while the use of molecular virological techniques were lagging in certain laboratories adequate research was carried out on immunological aspects of porcine virus infections related to ASFV or CSFV infections. It was clear that a training program for virologists in all the participating laboratories was needed. The coordination budget of the swine fever virus program made it possible for virologists from the participating laboratories to travel to other participating laboratories and to learn new technologies in virus research. The exchange plan lead to a quick transfer of technology and to improved understanding among virologists of different nationalities. The exchange program was successful in providing a good basis for personal acquaintances and understanding. Soon it was evident during the scientific discussion in the seminars and workshops, each one hosted by a different participating laboratory, that cooperation had started. The system of meetings in different countries each organized by a participating laboratory, was to meet and learn about the science and life in a neighboring country.

The first seminar in the series was on “Porcine Immunology” in Thiverval-Grignon in September 1973, the second was on "Studies on Virus Replication" in May 1974 in Brussels. This seminar was planned to take place in Lisbon but was transferred to Brussels due to the political changes in Portugal after the passing away of President Salazar. The third seminar on “Diagnosis and Epizoology of Classical Swine Fever” was in May 1975 in Amsterdam and the fourth seminar was on the “Eradication of African and Classical Swine Fevers” in September 1976 in Hannover.

The major theme in the seminars was on Classical Swine Fever (CSF) research and the immunological aspects of swine immune responses to CSFV and ASFV. In the seminar on "Virus Replication" in 1974 molecular virological aspects of the two viruses were included in the programme. The research on the humoral immune response of pigs after infection by the two swine viruses was of importance to the development of diagnostic techniques to identify ASFV and CSFV in diseased animals and in pig meat. Based on these studies, it was possible to develop a EEC test to differentially diagnose the two swine fever viruses and to establish, in all participating states, a network of laboratories capable of differential diagnosis of swine fever viruses, making it possible for each participating state to detect infection with ASFV in the infected index herd. (The first herd in the country which is infected by an exotic swine fever virus). The Madrid laboratory was appointed to prepare the diagnostic kit for ASFV which was provided to all participating laboratories and to train virologists from all the laboratories participating in the program to use the diagnostic test. This network was successful in the detection of ASFV in the member states, for many years to come leading to a rapid eradication of the infected animals.

Although several of the participating laboratories had the techniques to purify the infectious particles of CSFV or ASFV from the infected cell debris, this part of the research program was not advanced. Purification of the virus particles was necessary to obtain the virus nucleic acid (the viral genetic material) and the structural coat proteins which are the viral antigens. Such purified proteins could be used to improve the tests for virus diagnosis. A series of workshops were organized to deal with the purification of the swine fever viruses: The first was on "Diagnosis of African Swine Fever", February 1975, in Madrid, Spain; the second was on "Concentration and Purification of the Hog Cholera Virus" in March 1975, in Perugia, Italy; the third was a workshop on "Diagnosis of Classical Swine Fever" in May 1975, in Leylistad, Holland; the fourth was on "Immunological Techniques" in Lindholm, Denmark, in June 1975; the fifth was on "Virological Methods" in September 1975, in Utrecht, Holland.

The intensive workshops activities in 1975 provided an in-depth analysis of the research on classical swine fever virus. The research on ASFV lagged behind and so did the molecular analyses of this virus. To overcome this gap in ASFV research, an international team of virologists came to Madrid to work together with members of Madrid ASFV laboratory to purify ASFV and to characterize some of its molecular properties. This scientific effort took place during one week, 10-16 September 1975 research teams were formed: a) The electron microscopy team. The ASFV-infected cell cultures were prepared and the virus was visualized by electron microscopy and the ASFV virus DNA was viewed and measured. These experiments provided information on th viral DNA genome b) The molecular biology team studied the viral DNA, the viral messenger RNAs, and the viral coat proteins. Viral antigens were isolated and characterized. At the beginning of the next week the team presented the report on ASFV to Mr. Craps and his staff in Brussels. Soon after, the United Kingdom research team on ASFV published molecular studies on ASFV and thus the research on ASFV reached the same level of achievements obtained by the CSFV researchers.

The second EEC research program provided information on both viruses, achieving the following results: 1. CSFV and ASFV were purified and their nucleic acids (CSFV RNA genome and ASFV DNA genome) were characterized. 2. Viral structural (coat) proteins of the two viruses were analyzed and their antigenic properties were defined. 3. Diagnostic tests to identify CSFV and differentiate it from Bovine Virus Diarrhea Virus (BVDV) which also infects pigs and a ASFV diagnostic test was developed. 4. Studies on the immune system of the pigs were advanced to understand the humoral and local immune responses of pigs to infection by each of these two viruses. Thus, the EEC research team fulfilled the initial request of Mr. Raymond Craps to provide the veterinary services with scientific tools resulting from the EEC project to help the farmers to prevent and contain virus diseases in the pigs herds.

The success of the second EEC program led EEC DG VI leadership to question how to phase out this successful research program after ten years of activity and after reaching the goals of the program. During the ten year period of the EEC supported virus research programs, molecular virological technologies were advanced in all the participating laboratories. It was suggested that the ASFV and CSFV programs should achieve a practical EEC goal: protection of EEC member states from the invasion of the exotic ASFV which could enter by illegal importation of infected pigs or by plane refuse fed to pigs. My suggestion was to develop a Network of Diagnostic Laboratories, each with a designated "Reference Center", in different EEC member states. Each laboratory will be responsible for continuous improvement of the diagnostic procedures of one of the agriculturally important viruses. The reference centers will be used for training of virologists from all EEC member states in the use of the virus diagnostic techniques, and for the provision of the diagnostic kits for rapid virus diagnosis to the members of the Network. These activities were supported by the EEC DG VI coordination budget. The reference centers were: The Madrid laboratory for ASFV; and the Hannover laboratory for Classical Swine Fever Virus, and each country designated a national laboratory as a member of the Network. The network ideas were presented to and approved for funding by the standing committee on Agriculture in its meeting in Brussels. For years after the end of DG VI virus research programme the Reference Centers continued to function.

After the completion of the Swine Fever Program, the research funds in DG VI declined while ASFV continued its spread into the islands of Malta and in Sardinia. The decision of the EEC leadership was to finance the eradication of all pigs in Malta by paying compensations to the Maltese farmers for the eradication as well as for the repopulation of the pig population. In Sardinia the attempt to stop the spread of ASFV infection was less successful and wild pigs on the island were infected. Since Sardinia, is an island, with the use of diagnostic measures ASFV was contained and did not spread to the mainland of Italy. The ASFV Network for diagnostic procedures was proven useful in the eradication of the index ASFV infected pig herds near the Brussels airport which were fed with refuse from airplanes. As a result of rapid diagnosis of ASFV the spread of the virus was stopped by the Belgian Veterinary services.

To achieve Mr. R. Crap's ideas to "provide the scientific results of the EEC projects on agriculturally important viruses to the farmers" members of the Department of Legislation in DGVI had to be convinced to listen to the advice from the scientists involved in the virus research projects. This idea was suggested by the participating EEC virologists since they had the diagnostic tools which will help to curb virus diseases in animals. The forthcoming project on Bovine leukosis virus and disease had led to cooperation between the researchers and the EEC legislators in agriculture with marked benefits to the EEC farmers.

B. The Third Phase of EEC Supported Research on Swine Fevers and Enzootic Bovine Leukosis (1976-1981) Coordinated by F-4 DG VI Agriculture.

While the laboratory research on swine fevers was being phased out and the reference centers and networks continued to function a discussion on the next virus research programme was in progress. At this stage, it was already accepted that the research projects on virus diseases of animals significantly contributed to the agriculture in EEC member states. The planning of the new research program on virus diseases took into consideration the following aspects:

a) The virus which will be selected for the next research project should be a cause of an economically important disease in farm animals which concerns all EEC member states; The subject of choice was Bovine leukosis disease in cattle. This virus disease was spread in all EEC member states and although it did not infect humans nor killed cattle it caused economical damage to the farmers. b) The research project should be an EEC collaborative project aimed at providing the EEC member states with improved diagnostic technologies which will be used as the EEC compulsory diagnostic test to diagnose the infected cattle. c) To achieve scientific cooperation among scientists from seven participating laboratories. The participating virologists were encouraged by the coordination program to visit the laboratories in other member states for scientific discussions, exchange of available data on BLV and provide or exchange reagents prior to the initiation of the program. d) It was clear from the start that this research project on Bovine leukosis and its causative agent Bovine leukosis virus (BLV) in the EEC laboratories must develop in a rapid pace to advance faster than the research on swine fever and to be completed in a period of 5 years. e) EEC workshops on BLV were to be opened to the participation of BLV virologists from around the world.

At the start of the EEC research program, it was necessary to bring the participating scientists to an understanding that in this EEC project the goals to be achieved should be for the benefit of all EEC member states. It should be indicated that virologists from the participating laboratories were asked by their national ministries to participate in the BLV program which was funded by the EEC DG VI Agriculture. The scientists were already involved in research on BLV in the framework of the national research programme and thus the projects were started quickly.

The first workshop on bovine leukosis was organized by one of the participating laboratories in Germany and all other participants were asked to bring to the workshop samples of the BLV preparations from their laboratories. All the virus samples we analysed in one experiment and the viral proteins were identified to achieve an EEC nomenclature of the viral proteins to have an agreed proteins nomenclature. The outcome of the first workshop signalled to all the participants that the BLV project is indeed a collaborative EEC program and its goals are to provide the EEC with tools to eliminate infected bovines and protect the EEC member states from the importation of BLV infected cattle. At this stage, the participating virologists applied their findings to assist EEC Veterinary legislation by providing a common EEC diagnostic test to detect BLV in the animals in the field. The successful and enthusiastic scientific cooperation between the scientists was instrumental in the subsequent rapid developments of the basic knowledge on the molecular biology of BLV which was applied to the development of an EEC standardized diagnostic test to identify BLV infected cattle. The EEC diagnostic tests led to the Control and Eradication Programs of Bovine Leukosis in EEC member states. Due to the EEC legislation that prevented the importation of BLV-infected cows to the EEC member states, the Central Council on Agricultural Research and the leadership of DG VI started to plan an eradication program to eliminate BLV-infected cattle herds in all EEC member states with compensation to the farmers in the EEC member states from the EEC budget. Another benefit was the monitoring for anti-BLV antibodies in the blood of humans involved in the preparation of bovines for human consumption. Tests revealed that BLV did not infect humans thus concluding that BLV is not a hazard for humans. Six EEC workshops and symposia on BLV were held in six of the participating laboratories: the first symposium was in Copenhagen in 1975, the last in Bologna in 1980. All the symposia were published by the EEC.

The legislation on the EEC compulsory test for BLV was passed and the veterinary services of all member states. Cattle to be imported to an EEC member state needed to have a certificate of being free of BLV using the EEC approved BLV diagnostic test. This led to the cessation of importation of BLV infected cattle to all EEC member states. Thus, the EEC research program on BLV led to one of the EEC economical successes in agriculture, which brought about the strengthening of the European Economical Community through a successful cooperation between virologists, veterinarians and EEC legislators. In parallel to the BLV research project, workshops were held on additional animal diseases: Marek's disease in chickens, sheep respiratory diseases, Foot and Mouth disease of cattle, and slow viruses (scrapie) of sheep. One of the last workshops was the scrapie workshop in the Edinburgh laboratory. The possibility that scrapie of sheep may cross species barriers and cause Creutzfeldt-Jacob disease in humans was discussed and it was concluded that research on scrapie should have a high priority for the EEC research programme on viruses for the 1984-1989 period. In the 1984 recommendation to the standing committee on Agricultural Research for the next 5 years the research program on the sheep scrapie agent was the most urgent subject. Before the proposal for the EEC program on viruses was evaluated in DGVI the Directorate General XII (science) started to function, and the research budget of DG VI Agriculture was transferred to DG XII, leaving a small budget for coordination of the ongoing research. One can note that the first case of prion (scrapie agent) disease in a cow which received the name “Mad Cow Disease” was discovered in the UK in 1985. One may speculate that if the scrapie research program had been supported by an EEC research program, the emerging bovine spongiform encephalitis (BSE) in cattle in the UK may have been researched when the first diseased cows were detected, and perhaps the spread of BSE in UK cattle could have been prevented.

C. A Proposal for the Development of a Regional Network on Virus Diseases in the Middle East and Neighboring Countries

The development of a network of virus laboratories for research on swine fevers in pigs in EEC member states (Spain and Portugal included) and on bovine leukosis in cattle provided the members of the European Community with valuable results. These achievements provided building blocks to strengthen the economical development of Western Europe. These achievements came about as a result of the long range vision of Mr. Raymond Craps and the Standing Committee on Agriculture in the EEC Directorate General VI Agriculture that provided the financial support of the research. The concept of Mr. Craps that “the results of the scientific research should be used to improve the standard of living of the farmers in the EEC” achieved an understanding and kinship among participants from the different nations and proof that scientific collaboration could lead to successful results to the benefit of all member states. Within a period of ten years of the research program (1971-1981) the EEC legislation on virus diseases protected the EEC member states from of ASFV and BLV epidemics. The eradication of BLV infected cattle in the EEC member states with compensation by EEC to the farmers was achieved. The economical benefits to the EEC member states and to the farmers in these countries greatly supported the understanding that EEC coordinated research holds great promises for benefits for the peoples of the member states. I regret that the EEC DG VI Agriculture, especially the plan to develop a research project on scrapie in sheep, did not materialize. If this project on sheep scrapies had been carried out by a network of laboratories supported by the EEC, I have no doubt that the first cow in UK with the symptoms of “mad cow disease” would have quickly been investigated and controlled.

The situation now in the Middle East differs markedly from that in Western Europe in the period 1966-1984. Yet it should be remembered that the EEC started to function in 1962 with the aim to become a European Union (EU) in 1992. In 1971 when I started my involvement as a scientific advisor to the EEC projects on swine fevers, there was an understanding that the research programs should aspire to achieve the economic goals. Contrary to the EEC, in our region the idea of developing a Middle East Economical Organization (MEEC) has not been exploited by the four parties to the Regional Peace.

In the absence of a “Middle East Economical Community (MEEC)” it is suggested to develop a Middle East Regional Scientific Cooperation Network System (MERSCNS) involving researchers in the field of human health, veterinary research plants research and academic research from the four parties to peace together with European, American and Japanese Scientists. The potential economical benefits from Middle East Regional Scientific Cooperation Network System is presented in Table 1. Figure 1 illustrates the Regional Scientific Network, which will be organized by a central committee and allow the rapid flow of information on diseases among the participating parties.

D. The Eilat Statement On Science For Peace And On The Need To Develop A Middle East Regional Scientific Cooperation Network System (Merscns)

To initiate the planning of a Middle East Regional Scientific Cooperation Network System, the UNESCO-Hebrew University of Jerusalem (HUJ) International School for Molecular Biology and Microbiology (ISMBM) (inaugurated in December 1995) organized the First International Workshop on Virus Diseases in the Middle East and Neighboring Countries at the Inter-University Institute in Eilat (23-28 March 97) in the framework of its scientific and Science for Peace activities. Fifty six participants from Jordan, Palestinian Authority, Egypt, Cyprus, Italy, Germany, USA, and Israel participated in the workshop.

Table 1

The Potential Economical Benefits from the Middle East Regional Cooperation Network System

a. Improvements in laboratory facilities including advanced computational systems will lead to immediate benefits to agriculture and the population due to early diagnosis of virus diseases of humans, animals, fish and plants, and in the development of preventive and eradication measures to protect the food resources.

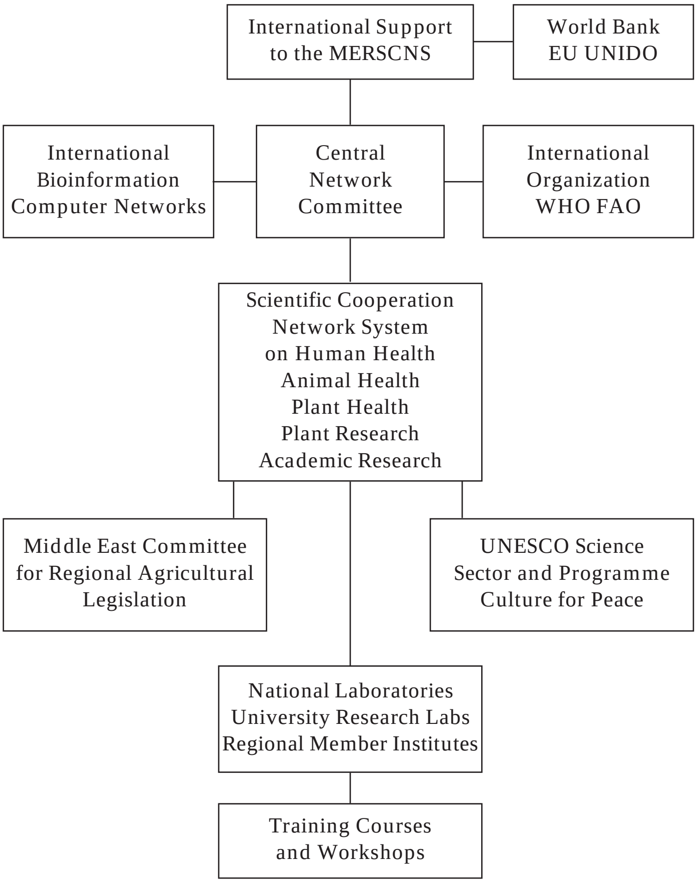
b. The regional network central committee will be responsible for the transfer of scientific information for the benefit of the farmers in all nations in the region by collaboration with the regional and international environmental agencies.

c. The improvement of the research activities of the cooperation between national research institutes and universities in the region will be beneficial to all members and will increase the level of scientific knowledge region-wide. This will be of great benefit to the populations of the region and to its economy.

d. The immediate benefit to the population:
   1) Better protection of the population from human viral diseases
   2) Better protection of the national food resources (animal meat, fish) and plants (crops, vegetables and fruit)
   3) Advancement in the development of unified veterinary legislation on the protection of animals of the region, (e.g. to prevent the entry of virus-infected animals, fish and plants into the region).
   4) The contributions to regional protection against disease will eventually make possible the eradication of virus infected animals, fish and plants and will allow improvement of the genetic stocks of animals and plants. This will allow commerce between the participating parties and regional economical organization like the EU and other international markets. This may provide immediate benefits of the populations of the parties in the Middle East.

Figure 1

Organizational Plan for a Regional Network on Virus Diseases



The Eilat Statement on Science for Peace (Appendix I) was discussed and approved by the participants of the workshop who also approved and supported the Jerusalem Statement on Science for Peace to ensure that "scientific endeavors and achievements be used only for peaceful purposes and for the greater benefits of humanity". The workshop participants had decided that recommendations for the organization of MERSC-NS should be prepared for submission to UNESCO Paris and UNESCO Venice Office for support. At the same time the activities to form the Middle East Regional Scientific efforts should be initiated according to the recommendations to the Eilat Statement on Science for Peace. (Appendix I).

E. Concluding remarks

The EEC programmes on virus diseases of farm animals during its nineteen years of research activities (1966-1984) had made an important contribution to the EEC developing economical strength and provided the European farmers with the benefits of scientific discoveries. Above all, the collaborative research activities by teams of dedicated scientists had contributed to the understanding and friendships between scientists from all EEC member states, Portugal and Spain. These programmes had revealed that targeted research on economically important viruses within a collaborative effort can successfully provide both basic scientific knowledge and scientific solutions to agricultural problems thus having a positive impact on the economy.

From my experience as a scientific adviser to the EEC projects, I believe that the EEC model for the enhancement of cooperation and for the protection of the regional food resources can be used to help the development of other regions in the world. A workshop to start such scientific cooperation in the Middle East was organized by the UNESCO-HUJ ISMBM. A Middle East Regional Scientific Collaborations Network to protect humans, animals, fish, plants and the environment may, in the future, encourage the creation of a peaceful atmosphere for collaborative activities that will advance the standard of living of all the populations and help in bringing the culture of peace to the Middle East. The creation of the Middle East Regional Scientific Cooperation Network is now the goal.

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This paper is dedicated to Mr. Raymond Craps, Direction F-4, DGVI, EEC, for his vision and foresight in developing the research programme on virus diseases of agricultural important animals and insisted "that the benefits of the research should be used to benefit the EEC farmers" and for his support to my idea of developing scientific networks for virus research and to the memory of Professor Manso-Ribeiro, Lisbon, Portugal, a pioneer in the research on African swine fever in Portugal.

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APPENDIX I

The Eilat Statement on Science for Peace and on the Need to Develop a Middle East Regional Scientific Cooperation Network System (MERSCNS)

Members of the international scientific community of research on virus diseases met at the Inter-University Institute in Eilat 23-28 March 1997 to participate in the First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries. The Workshop was organized by the UNESCO-Hebrew University of Jerusalem International School for Molecular Biology and Microbiology with the motto “Science for Peace” and supported by UNESCO, Paris, UNESCO Venice Office, UNESCO-Global Network for Molecular and Cell Biology (MCBN) and the Hebrew University of Jerusalem.

The aims of the workshop: 1) to explore the state of research on virus diseases of human, animal, fish and plants by bringing together the scientists dealing with these virus diseases in the Middle East and neighboring countries; 2) to explore ways for regional cooperation on virus diseases since viruses move freely through man-made borders and 3) to explore the development of a Middle East Regional Network of virus laboratories to enhance the cooperation among scientists for the benefit of the peoples of the Middle East and the neighboring countries.

The participants of the Workshop accepted and supported the Jerusalem Statement on Science for Peace and its recommendations, which were accepted earlier by the participants of the Second International Symposium on Science for Peace (19-24 January 1997), to ensure that: 1) scientific endeavors and achievements be used only for peaceful purposes and for the greater benefit of humanity; 2) free movement of members of the Academic -scientific community; 3) free flow and sharing of scientific information and knowledge; 4) the academic environment remains open and dedicated to free expression of ideas.

In the Eilat Statement on Science for Peace the participants of the First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries recommend to Prof. Maurizio Iaccarino, Assistant Director General for Science, the UNESCO Science Sector UNESCO, Paris:

1) to support and develop a Regional Network of Virus Laboratories in the Middle East to enhance virus research by sharing information and by scientific cooperation for the benefit of the people in the region.
2) to establish a series of scientific workshops in the framework of the Regional Middle East Network to enhance participation of scientists from the region and from other countries to discuss and plan collaborative research projects;

These regional scientific activities will enhance the understanding between scientists and will be beneficial to the peoples in the region.

A. Background

The participants of the First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries, Eilat 23-28 March 1997, have agreed upon the following:

a) Approval of the Eilat Statement on Science for Peace and its principals.
b) The Need to Develop a Regional Scientific Cooperation Network for the Middle East (Appendix I).

B. Recommendations

The discussions on the Middle East Network of Regional Scientific Cooperation led to the following recommendations based on recommendations of the Eilat Statement on Science for Peace:

To ensure sustainability and institutionalization of scientific activities in the Middle East among the four parties Egypt, Jordan, Palestinian Authority and Israel, it is recommended to establish and develop a Regional Network, with the proposed title "The Middle East Regional Scientific Cooperation Network System (MERSCNS)", to pursue research on subjects of importance to the region, including: veterinary aspects and animal health, human health, academic research in molecular biology, genetics, microbiology and research on plant issues.

C. Proposed objectives of the Middle East Regional Scientific Cooperation Network System (MERSCNS)

The participants of the Eilat Workshop recommend that the objectives of the Network System will be as follows:

Objective 1: To cooperate in scientific fields such as joint research, regional training on scientific subjects of importance to the four parties in the region, exchange of scientists, exchange of scientific information and knowledge using all means of communication and information systems.

Objective 2: To encourage more involvement and support of UNESCO in the development of scientific cooperation between institutes and universities in the Middle East by promoting the Regional Scientific Cooperation System to expand regionally and internationally.

Objective 3: To use existing regional structures (e.g. Regional Oversight Committee on Veterinary Issues (ROCV) as a model for developing the Central Committee for the Middle East Regional Scientific Cooperation Network System (Appendix I).

Objective 4: To seek the help of UNESCO in the initiation of contacts of the four parties with international organizations as well as potential donor countries to seek financial support and scientific cooperation. UNESCO and the donor agencies and countries will have relevant representation in the Central Committee for the Middle East Regional Scientific Cooperation Network System (Appendix I)

D. Recommended Actions

The participants of the Eilat Workshop decided on the following :

1) to elect Prof. Y. Becker to be the coordinator of all the activities of the Central Committee for the Middle East Regional Scientific Cooperation Network System within the framework of his role as the Director of the UNESCO-HUJ International School for Molecular Biology and Microbiology (ISMBM).
2) to hold the Second International Workshop on Virus Diseases in the Middle East in 1998 and 1999 in Jordan and Egypt as an alternative.
3) to hold a training course in basic and molecular virology for new graduates of the four parties (5 participants from each party)
4) The Central Committee will dedicate its efforts in scientific cooperation to enhance the welfare of the peoples in the Middle East, and promote the Peace in the region.

Science for Peace
Potential Roles for International Partners

James P. Vary
International Institute of Theoretical and Applied Physics
Sponsored by Iowa State University, Ames

I. Introduction

It was the vision of physicist and Nobel Laureate Abdus Salam that scientific knowledge become more widely shared between the developed and developing countries. His relentless efforts led to the formation in 1964 of the International Centre for Theoretical Physics (ICTP) in Trieste, Italy, and he provided strong guidance and assistance to the formation of the International Institute of Theoretical and Applied Physics (IITAP) at Iowa State University (ISU) in 1993. The foundations of both institutions are rooted in the UNESCO charter and receive major support from UNESCO.

We would do well to recall Salam’s vision and the UNESCO charter as we address the issue of “Science for Peace” since a wider sharing of scientific knowledge promotes dialogue and reduces suspicion among neighbors. Increasingly, scientific knowledge and the resulting link with technological progress, hold the keys to sustainable economic development.

With this backdrop from the physics community’s perspective, it is a privilege for IITAP to be invited by the UNESCO-Hebrew University of Jerusalem International School for Molecular Biology and Microbiology (ISMBM) to participate in organizing this meeting on “Science for Peace.”

From the program, we see that we will address both the general issues, affecting many situations around the globe, as well as the Middle East regional issues. It is our hope that we will develop some consensus on major issues affecting peace as well as the specifics appropriate to this region.

One of the questions we address is how we, as scientists and educators from different disciplines, can contribute significantly to the peace process here and elsewhere.

I will take the perspective of the outsider looking in on the Middle East and asking this question. It is a privilege to share some thoughts on how IITAP, like ICTP and other international organizations, has been working in this direction. Then, I will share some thoughts on the potential for future joint actions.

II. Previous Actions - Scientific Exchanges

We might recall that international scientific organizations and institutes generally promote the gathering of scientists from all countries for the purpose of scientific dialogue. This occurs in the form of conferences, workshops and schools. In addition, many institutions also sponsor vigorous programs for both short term and long term visits.

IITAP has been active in these areas with more than seven hundred sponsored visits to date and more than twenty international meetings organized.

These activities provide opportunities for professional development of the participating scientists as well as cross-cultural experiences and interactions. It appears well-accepted among basic scientists that scientific interactions form a solid basis of communication from which one may experience broader exchanges of views. These broader exchanges often provide new insights into the perspectives of our neighbors and foster a climate of increased trust and cooperation.

Let us quickly review the scientific organization of IITAP to indicate what is currently available to the international community. An application process leads to possible participation in these projects or specific activities such as conferences. Further information is available by writing to me at the above address or by visiting our web site (www.iitap.iastate.edu).

II A. IITAP's Thrust Areas and Coordinators

Applied Science - David Hoffman
Biophysics - (to be appointed)
Computers/Communications - Bruce Harmon
Environmental/Earth Science - Gene Takle
Fundamental Science - Bing-Lin Young
Materials Science - David Lynch

The underlying scientific administration of IITAP is provided by the six Thrust Areas and their Coordinators. Coordinators review visitor applications, recommend support when appropriate and assist in securing scientific hosts for visitors. They participate in grant-writing efforts, development of conferences and workshops, setting the scientific agenda of their Thrust Area, visits to potential funding sources, making presentations at IITAP events and representing IITAP in various settings. Projects (see below) may exist entirely within a Thrust Area or may straddle two or more Thrust Areas.

II B. IITAP's Projects and Coordinators

Overlaying IITAP Thrust Areas are a series of Projects launched to achieve specific objectives. All Projects have secured external funding or funding through a collaboration with another unit at Iowa State University. Some Projects are interlinked. Some visitors may participate in more than one Project during their stay at IITAP. In the order of their foundation these projects and their coordinators are:

Networks for Use in Math and Physical Sciences (NUMAPS)
Doug Fils and Bruce Harmon

Through NUMAPS and its two month training program, about 10 participants receive training and extensive hands-on experience with Internet, IntrAnet and other network technologies. Participants gain programming experience with Common Gateway Interface (CGI), Java, JavaScript, virtual reality modeling language (VRML), Hyper-G, video conferencing software, multimedia software and much more. NUMAPS97 has participants from China, Egypt, Czech Republic, Nigeria, El Salvador, and Ukraine.

Training and assistance in techniques taught and applied in NUMAPS are provided as a service by appointment. NUMAPS is providing leadership in the development of on-line courses and course materials.

Whole Earth Telescope (WET)

Steve Kawaler

With partial funding from the National Science Foundation, WET functions as a collaboration of groups from twenty institutions, widely distributed over the globe, to coordinate observations of variable stars. WET provides uninterrupted data for the variations in light output over a period of a few days. The data reveal the dynamics of stellar behavior. WET runs two observing cycles per year each for about two weeks. In addition, WET holds an international meeting each year and this year it will be held in July in Poland.

Information Services on Internet

Doug Fils

IITAP's fast growing Internet Server provides educational and research resources in the physical sciences, mathematics and engineering. Key resources include High Tc Update, a biweekly newsletter containing features and abstracts of the latest preprints submitted for listing. Several years of past issues are available with search engines for rapid information retrieval. A growing set of educational resources such as course materials for physics courses, engineering courses and a Global Climate Change course are maintained on the server. During this year, IITAP placed an interactive, full text, physics book, “Physics the Root Science” on line. Hard copies of the book are also available for purchase through IITAP.

Computational and Applied Mathematics

Alric Rothmayer and Bruce Harmon

With support from United Technologies Corporation (UTC), this project hosts a number of Russian visitors each year. Consultations are in process for a new project to support Russian scientists to write reviews on selected specialty areas of institutes in the former Soviet Union which would be of interest to corporate sponsors.

Kharkov Link

David Hoffman and Victor Eremenko (Kharkov)

As a leading representation of IITAP’s link-building efforts, the IITAP / ISU - Kharkov Link aims to support high-end communications, distance education / training, collaborations and technology transfer. The Institute for Physical Research and Technology’s (IPRT’s) Center for Advanced Technology Development (CATD) is working in partnership with IITAP to develop this link to the Kharkov region of the Ukraine, noted for its advanced research and high technology centers. An IITAP office, supported in part by the Kharkov Institute of Low Temperature Physics and Engineering, opened in September 1996. A major delegation from ISU / IITAP visited Kharkov in September, 1996 to conclude agreements and to participate in inaugural activities. Numerous activities are in the formative stages with visitors traveling in both directions to carry out the planning and training functions. Anatoly Frishman serves as the primary facilitator for developing the Kharkov Link Project.

Krasnoyarsk Link

David Hoffman and Vladimir Kureshov (Krasnoyarsk)

This region of Siberia, Russia, represents a major center of high technology and scientific expertise. Similar to its actions with Kharkov, IITAP is working in partnership with CATD to develop a link with the region. An IITAP office, supported in part by the Siberian Aerospace Academy, opened in September 1996. A major delegation from ISU / IITAP visited Krasnoyarsk in September, 1996 to conclude agreements and to participate in inaugural activities. Anatoly Frishman serves as the primary facilitator for developing the Krasnoyarsk Link Project. Numerous activities are in the formative stages with visitors traveling in both directions to carry out the planning and training functions. Another ISU / IITAP delegation is scheduled to visit Krasnoyarsk in July, 1997.

International Women in Science and Engineering (IWISE)

Mary Ann Evans and Ardith Maney

IWISE aims to provide enhanced opportunities for women scientists and engineers from developing regions to update their professional skills and receive leadership training. IWISE is running its second pilot project this summer with 16 women from the countries of Nigeria, Ukraine, Russia, Kenya, Ivory Coast, and Tanzania.

A four minute pilot video for IWISE fundraising is now available on-line from the IITAP web server. It features Ethelvina de Escobar, Assistant Dean of the Faculty of Sciences at the University of El Salvador (UES) and a faculty member in the Department of Physics at UES. In the video she portrays her research with her students in solar energy devices for use in remote villages of El Salvador for cooking and water purification. IITAP has recently secured National Science Foundation funding for projects involving Prof. Escobar and the IPRT's Microelectronics Research Center (MRC).

Research and Education Resources

The need for access to research and education resources is especially strong in developing regions. IITAP addresses some of these needs through its Document Delivery Service (DDS) operated in cooperation with the Parks Library at ISU. Via DDS, researchers and educators can order photocopies of literature available at Parks. A pilot program completed in mid 1995 demonstrated the feasibility of the service. While DDS now operates on a charge basis providing full cost recovery, IITAP is seeking funding to reduce the costs to those needing the service in developing regions.

Through an agreement with Archimedes Publications Ltd., IITAP has placed on-line an Internet version of the pre-calculus physics textbook titled Physics - The Root Science - with Applications. In addition, IITAP accepts and processes orders for the hard bound text and supplements (teacher's guide and problem solutions manual).

A new project to create an electronic interactive learning environment for college calculus has recently been inaugurated in a partnership with Suez Canal University and support from the UNESCO Office in Cairo. The materials will be prepared both in English and Arabic. The project is spearheaded by Samir El Khabiry and Mohamed Mahran (Suez Canal Univ.)

Eastern Europe Technology Access Program (EETAP)

James Vary, Bruce Thompson and Anatoly Frishman

The William and Mary Greve Foundation, with matching contributions from United Technologies Corporation, worked with IITAP to distribute a second set of four $10,000 fellowship awards. IITAP will soon begin hosting the visits of the 1996 Greve Awardees to the US. During 1996 several 1995 awardees visited IITAP and a number of US universities and corporate research labs to present seminars and explore areas for cooperation. IITAP has completed a partnership with IPRT's Center for

Advanced Technology Development (CATD) to provide technology transfer services where appropriate and David Hoffman serves as liaison for IITAP with CATD.

New support from the Greve Foundation in 1996-97 has allowed IITAP to develop its marketing approach for EETAP aimed at the acquisition of additional corporate sponsors.

Project to Intercompare Regional Climate Simulations (PIRCS)
Gene Takle, Bill Gutowski and Ray Arritt

Launched in November 1994 with a workshop at IITAP, PIRCS seeks to advance the status of regional climate modeling by evaluating the strengths and weaknesses of limited-area models and their component procedures through systematic comparative simulations. Workshops are held periodically to share the latest scientific developments and compare results achieved by different groups on standard cases for which good data exist. PIRCS is now supported in part by a contract from the Electric Power Research Institute (EPRI).

III. Previous Actions - UNESCO Middle East Mission

Participation in most of IITAP's Thrust Areas and Projects involves travel over great distances. The issues at this meeting might benefit from concentrated action in the Middle East itself. This poses a number of challenges to an international institute such as IITAP and requires considerable study and evaluation.

After lengthy deliberations, UNESCO asked IITAP to undertake a "UNESCO Mission to the Middle East" in March 1995. The mission was conducted by Hildegard M. Vary (HV), Galileo Violini (GV) and me (JV). Two excerpts from the Mission report are provided here as proposals to this Symposium in order to bring these issues into the discussion.

Abstract

This report summarizes a UNESCO Mission to the Mid-East, conducted by the authors, to explore opportunities for multi-lateral projects of cooperation in science and technology. The mission was stimulated by the evolving peace process in the region. We conclude with a recommendation that UNESCO sponsor the development of a premier international institution for higher learning in the Mid-East with emphasis on advanced studies and research in the natural sciences, agricultural science and engineering. Technical training at the bachelor's level is also a priority need. This report proposes steps to achieve this goal.

Introduction and Executive Summary

The situation in the Mid-East concerning higher education and research in science and technology is uneven and clear needs for improvement exist, especially for Palestinians. This has prompted consideration of possible international cooperative actions that would address these important issues, while building additional bridges of communication for the region.

In the last few years, UNESCO has paid special attention to the issue of peace and to the diffusion of the culture of peace. Moreover, with the development of the peace process in the Mid-East, UNESCO has received several proposals for actions within its traditional sectors of activity, such as sponsorship of meetings or support for the creation of new institutions.

Consequently Dr. Federico Mayor, Director General of UNESCO, established this mission to explore with government and university officials in the region the feasibility of various projects and to identify the advisable roles for UNESCO.

The report is a synthesis of the meetings and discussions we had and represents our perception of these opportunities at the present time.

In view of the lack of advanced degree programs for Arabs in the region, we propose that UNESCO adopt the goal of establishing a premier international institution of higher learning and research for the natural sciences, agricultural science and engineering in the Mid-East. This institution should be fully accredited for degrees up through the doctorate. The special needs of the region justify a significant goal of providing technical training. A component focusing on government, diplomacy and conflict resolution could be included.

Utilization of advanced technologies for distance learning can significantly reduce the cost and time scale for the project while facilitating access to internationally outstanding educators and researchers.

The expected immediate economic benefits brought by a project of this magnitude will be attractive to local and international sponsors. Indeed, this support may be facilitated by a judicious choice of site with a recognized need for economic stimulation.

Immediate actions are needed to identify potential partners, within and outside the region, for institution building and to plan the appropriate steps to accomplish this goal. For this purpose, we propose that UNESCO empower an international group of educators, researchers and science policy makers to further elaborate on this goal and to develop and initiate a process for achieving it. The project requires seed funding from UNESCO of $50,000 / yr. for two years and will be leveraged by $200,000 / yr. sought from other sources.

IV. Suggestions for Future Actions

It is still my personal conviction that establishing a premier international institution of higher education and advanced research would provide a boost for self-sufficiency and economic development in the region. IITAP is prepared to play a role which is acceptable to all parties in promoting the planning, development and success of such an institution.

As this is an ambitious undertaking, which will evolve over an extended time period, IITAP is prepared to take other intermediate steps deemed productive in the consensus view of the scientific community. We are looking forward to your ideas in these directions.

Of course, we will continue sponsoring visitors from this region to the US and elsewhere for participation in IITAP activities as this has proven a productive method for the generation and sharing of scientific knowledge and the promotion of "Science for Peace" through the development of new bridges of communication.

A Prescription for Peace in the Middle East

Sanford F. Kuvin
Chairman of the International Board
The Kuvin Centre for the Study of Infectious & Tropical Diseases
The Hebrew University - Hadassah Medical School

The medical facts of life today are that infectious tropical diseases cause more death and disability in the world then all other diseases combined. However, very little has been spoken or written about the distinct advantages or mechanisms of regional cooperation with regard to their immediate effectiveness on the health problems of the region, their pooling of complimentary talents, their cost effectiveness, and their longer term impacts - medically, socially, economically, politically and culturally.

In articulating the role of "Science for Peace" I would like to use as a paradigm the first regional cooperative program in health ever initiated between Israel and any Arab country which began in 1981, tell you how it came about, how success was measured, and then explain what the essential ingredients are, as we see it, for the success of future scientific projects and their practical contributions to peace. But first, because of time constraints, I will very briefly tell you that scientists at the Kuvin Centre have been involved in other regional programs with Jordan, Tunisia and Morroco, and even Lebanon, for almost two years before the peace agreement was signed with Jordan. We have also been involved with training Palestinian masters degree and predoctorol students for years, and are currently formulating new collaborative research programs with the Palestinian Authority. In addition to American financial support we are now beginning to realize Common Market interest and support in this quest of science for peace.

In the euphoric days after the completion of the Camp David accords in 1978 and the signing of the peace treaty in 1979, a U.S. Congressional initiative took place which sought to give greater content to Israeli/Egyptian amity and perhaps later, to include other Arab countries. The vehicle created to forward this end was the Middle East Regional Cooperative Program (MERC). This program began at the $5 million dollar level in the Foreign Aid Bill for FY(fiscal year) 1981 and has remained strong with excellent congressional support averaging $7 million dollars every year.

Kuvin Centre scientists were brought together with Egyptian scientists under this program because of a mosquito born viral disease, Rift Valley Fever, which entered Egypt like a storm in 1977 and 1978. It killed over two million head of livestock, several thousand Egyptians, and posed a direct threat to Israel and the whole Mediterranean littoral. This threat of disease stimulated the first regional cooperative conference in January of 1980 at the National Institutes of Health in Bethesda, Maryland between representatives of Ain Shams University of Egypt, The Kuvin Centre of the Hebrew University of Jerusalem and the National Institutes of Health to plan a trilateral project to investigate vector-born diseases of the Middle East of which Rift Valley Fever was the most threatening. This meeting resulted in the signing of a PASA or Participating Agency Service Agreement at the NIH on September 24, 1981 with the United States Agency for International Development (USAID) committed to administer and fund a multiple year project entitled "The Epidemiology and Control of Arthropod Borne Diseases in Egypt and Israel". The contract called for diseases to include not only Rift Valley Fever, but also malaria, and leishmaniasis with filariasis and rickettsial diseases added later. This $12 million dollar project was approved, reviewed, and renewed at appropriate intervals over the subsequent twelve year period of the program under the excellent direction of the Kuvin Centre's Project Officer Professor Rachel Galun.

Egypt, Israel and much of the Arab world lie in a very central position geographically at the crossroads of Africa, Asia, and Europe. In this unique location, this region long shared common health problems, and are now experiencing a wave of both new and re-emerging diseases. Countries in the region have open borders, a Jumbo jet arrives every 15 minutes from other countries and the mosquito does not recognize an international border or need a visa or a passport. We in this model project had a responsibility for not only dealing with regional health problems in a reactive way but also in a proactive way anticipating future health programs to expand regional cooperation on demand.

At the inception of this program, as Israelis, Egyptians and Americans we had many serious problems which were overcome by a persistence to go forward with the building of a unique espirit de corp within this pilot project. We had to ask ourselves repeatedly, how could this small program in regional cooperation persist, expand and thrive in a climate of great political instability and uncertainty. For example, we never hesitated in our scientific cooperative activities despite such deterrents as the Lebanese war, the dispute over Taba, the Intifada, and the ongoing political unrest in Egypt.

Well how did the world judge the success of a project such as ours. We clearly fulfilled our contractual scientific obligations with USAID and the NIH in fulfilling the research protocols of the diseases we agreed to study. We received excellent reviews by outside examiners and committees from both USAID and the NIH, and much was written in the international scientific press about our progress as the world watched from afar. But the real answers why this model project became successful evolved only as the program pressed forward.

Firstly, this ingathering of scientists became a true family affair. A family affair between the dedicated scientists at the Ain Shams Center for Vector Borne Diseases and those at the Kuvin Centre who devoted their careers, their hearts and their souls to the fulfillment of a dream - not a dream written into the shifting political sands of the Middle East - but a dream that became a reality written in over one hundred fifty scientific peer reviewed publications, with over thirty joint publications between the Kuvin Centre and Ain Shams, - the first in 3,000 years between these two ancient countries living side by side. This ***outcome oriented*** dream resulted in seven joint conferences in Stockholm, Aswan, Jerusalem and Shoresh, Hurghada in Egypt, Tel Aviv and Taba. This dream resulted in fifty real Ph.D. and Masters degree students that received support through and for this project, with Egyptian students and professors coming to Jerusalem, and with Israelis working and teaching in Cairo laboratories and classrooms. Like any family linked in a dependent and complimentary role, we also had our uncles, aunts and their relatives who took pride in our achievements and sometimes constructively criticized our actions. All we asked of our family was - as the first biblical commandment states -that we be allowed to “be fruitful and multiply”- to be allowed to not only continue our work, but also to expand our work and our cooperative scientific roles with our neighbors.

This formula for success is this first Vector Born Disease project dealt with real scientific and health problems of mutual concern. Indeed, ***Mutual concern*** is the first key ingredient to regional cooperation. Rift Valley Fever threatened the entire region, visceral leishmaniasis returned to Egypt after a forty year absence, and malaria remained an ongoing threat. Our scientific results in studying these diseases have had a definite and profound positive scientific, economic, political and cultural impact on the area. Mutual concern is essential to successful regional cooperation.

Secondly, the project was based on ***true cooperation*** between the Kuvin Centre and Ain Shams. Regional cooperation does not mean technical assistance. Not one of our joint projects could have been brought to success and fruition without the complimentary talents which existed between the dedicated scientists at the Kuvin Centre and those at Ain Shams.

Thirdly, ***institutionalization of the project*** was essential. Two prestigious universities, the Hebrew University of Jerusalem and Ain Shams University were totally committed in both countries as were their governments. In addition, the project expanded to involve researchers from other universities, other ministries and other research organizations in both Israel and Egypt. USAID quite rightly insisted on bringing in new faces and new programs and new institutions to expand regional cooperation. Permanency however can only continue if financial support will persist and be ongoing. This unique combination of USAID funding and NIH managerial skills with ongoing congressional support provided that formula.

Fourthly, the ***scientific integrity of the program*** was another ingredient that was obviously essential to the programs success, and therefore ongoing peer review, and technical consultants in a variety of disciplines were brought in whenever and wherever it proved necessary.

And so, the essential ingredients that we developed in this program are: **mutual concern, true cooperation, institutionalization of the project and quality research of practical importance to the region.**

But lastly, the culmination of twelve years of work and cooperation resulted in something that no contract, no authority, no publication, no meeting and no government could provide for any cooperative program, and that is ***complete trust*** amongst the participants living in a sea of mistrust. Trust in the professionalism, in the scientific judgment and in the steady and deepening friendship of the participants involved in this unique program. We at the Kuvin Centre and our Egyptian colleagues have completed in twelve years what governments have yet to accomplish - and that is the total trust necessary for a cooperative project such as ours to be and to continue to be successful.

We scientists in the United States know better than our Israeli and Egyptian colleagues of the serious impact of our own economic problems in funding research. We have serious budget deficits, serious trade deficits, we hear of threatened cuts in foreign aid, and we know the across the board reductions resulting from new laws on our books.

Yet despite these serious economic American problems we as Americans, Israelis and Egyptians who know every centimeter of this vector born disease program know full well that this tiny project was and is recognized as amongst the most productive, the most cost effective, and the most scientifically successful in the Middle East, and that is exactly why it continued to be renewed and funded for over a decade. New regional teaching and research programs emanating from this new international school will require the same ingedients and intensive lobbying by UNESCO scientific leaders from this new centre to convince world governments for support just as we convinced the American government of our mission to produce excellent "Science for Peace."

I would like to show you very quickly some slides which demonstrate to you some of the steps along the way which were necessary to successfully gather political support for a project such as this. **(Slides shown demonstrating the political leaders and the steps necessary in the political-scientific process of "Science for Peace").**

In conclusion let me emphasize that regional cooperation cannot be successful without the financial support of governments. At this stage of political maturity, Arab governments still require third party financial and political support, and in my opinion, *trilateral* programs such as ours will still be necessary for both funding and successful implementation until mutual trust between Israel and Arab governments have been firmly established. My experiences in funding have been primarily involved with the American sector, but UNESCO in this its 50th year, with its member governments, must similarly become involved in programs just like ours for “Science for Peace” to flourish. In America, the congress must be constantly lobbied and updated by people just like me, and around the world by people just like you. Equally important is to recognize the importance of appointed political ambassadors and science attaches from around the world who live and work in this region and who are active in the field. Their being continually informed and updated is essential for support.

UNESCO has a unique one of a kind opportunity to make this UNESCO-Hebrew University International School a significant success. Our formula for success can continue to act as a model for excellence in regional cooperation in what I call “a prescription for peace in the Middle East”.

Science and Peace in the Middle East Proposal for an Agenda

Galileo Violini
Physics Dept., University of Calabria, Italy

It is a great pleasure for me to have this opportunity of discussing some ideas about what Science and scientists can (or, perhaps, I should say must) do to strengthen the peace process in this region.

You may have noticed that my talk bears the title "Science AND Peace". In the program of this Symposium eleven talks refer to "Science FOR Peace", and only three, including mine, link these two words by "and".

Of course, in this way I did not want to deny the role that Science can play, and actually does play, for Peace. I am sure that this distinguished audience, despite the differences that exist in what concerns the scientific and geographic origin of its members, has as a common denominator the conviction of the importance of such role; similarly, I am sure that this common sentiment will find a visible expression in the approval, later during this Symposium, of the Jerusalem Statement on Science for Peace, that was presented in a previous talk (1) this afternoon and for which I cannot imagine a more adequate place for its approval than the "Town of the Peace" in its third millennial anniversary.

Thus, with this certainty in mind, I want to avoid the risk of simply adding my voice and making some obvious statement on Science for Peace, being sure that it would be absurd to think the contrary, if you allow me to paraphrase what recently wrote a well known Italian stateman (2). Instead, I will take the risk of centering my talk on the reverse aspect of the opportunities that in this region Peace will open for Science, which will lead to discuss some more controversial issue, and, as a consequence of this approach, on the feedback that this may have on the strengthening of the Peace process.

In the last three years I have been involved in a program of the European Union in El Salvador. This offered me a good opportunity of experiencing how difficult it is to establish peaceful and normal relations after decades of war. In the same region of the world, this appreciation was confirmed a few weeks ago, when I had the opportunity of following the ceremony for the signature of the peace in Guatemala. Again, the official speeches and the comments of the press the next day were full of hopes, but conscious of the problems posed by the need of a national conciliation.

However, it must be recognised that these difficulties are not equal in all areas of human activity, and there is no doubt that Science is one for which the establishment of post-war cooperation between former enemies may be easier.

This may be related, with the due cautionsness, to characteristics of the scientific endeavour such as tolerance, international character, solidarity independent of borders, and even more to the broad recognition that Science is essential for the technological, and consequently the economical development, which, once peace is achieved, always represents a prioritary goal for all parties previously involved in the war.

As an example of cooperation in Science between former enemies, much before the creation of other regional structures, one can mention the creation of CERN, which, with UNESCO's support, took place a few years after the conclusion of the Second World War, that is long before a significant development of the ideal of an united Europe led to establish economical, political and military structures.

Remaining in this region, here also examples may be found of this relatively easier cooperation in Science, both in the past and most recent history.

It is very instructive what is recalled in a paper (3) of some ten years ago by one of the participants in this Symposium, paper to which he made indeed reference earlier this afternoon. In that paper Yavin mentioned that, once, seventeen years ago, the peace between Egypt and Israel was achieved, a successful collaboration was established in at least three applied disciplines.

However, one should not feed the illusion that peace automatically creates conditions for cooperation identical, or at least similar, to what one would have in a different framework; and indeed, other proposals, specifically in Nuclear Physics, were not considered viable by the governments, despite the existence of favorable scientific conditions.

This indicates that the good will of the scientists may be not sufficient to launch cooperative programs, although the success of the Israeli- Egyptian initiatives in marine biology, medicine and agriculture shows on turn that Science offers any way a great potentiality for cooperation, in particular if one contrasts this success with the difficulties met by attempts of cooperation in other sectors.

A more recent regional experience, confirming that Science is a good area for cooperation, comes from the scientific meetings held in the Middle East after the Oslo agreements. They have succeeded in bringing together participants from all the region. As examples, let me quote the two Symposia of this series and the Dahab meeting on Physics of November 1995.

These experiences confirm the attention with which the scientific community follows the development of the peace process and its will of being an active actor in its strengthening.

On the other hand, some comment is deserved. This type of action had clearly been proposed in the Yavin's paper I was referring to (3). The fact that it has been successful only after the Oslo agreements indicates how essential is for success a suitable general political situation (2).

As a corollary, it is clear that these lines of cooperation have inherent elements of fragility, and it may happen, in particular at the beginning of the post-war, that a worsening of the political situation leads to last- minute cancellations of carefully organised events, in order to avoid failures, whose negative implication could be to push back the full process of establishing the cooperation.

To summarize these considerations, even with the limitations that may have what Science can do for Peace, in any case Peace opens new opportunities to scientific cooperation, probably more, or at least earlier, than other areas.

In this region, these opportunities make now possible to seriously consider the feasibility of ambitious initiatives, which not only correspond to scientific development, but also can lead to benefit other aspects of the society.

To be more specific about this point, about two years ago I carried out, in collaboration with Hildegard and James Vary, an exploratory mission for UNESCO in this region, the purpose of the mission being to identify possible actions to realize in the Middle East, in the new framework created by the Oslo agreements.

In our report (4) we expressed how one of the main needs in the region is the development of Palestinian scientific capacity. This goal requires to perform actions which overcome the scientific isolation suffered in the last decades by Palestinian scientists. Among the necessary actions, certainly must be included some program of permanent or temporary repatriation of Palestinian scientists abroad, but there is no doubt that, if one wants to develop the scientific level of Palestinian universities, the biggest investment must be made in the training of the youngest generations. Their advanced training cannot be carried out on the basis of the current existing Palestinian capacity only, but will require a strong international cooperation as well, in order to realize programs which should include studies and training both abroad and in the country and the region.

Activities of research abroad are indeed necessary, but in the present situation everybody would agree that this implies the risk, associated with such an action, of so favoring brain drain (5). Thus, for what concerns the phase of high-level training, the most appropriate action seems to be one at regional level, with international support.

Basically, one can imagine three lines of activity for such an action:

- strengthening of the capacity of local universities
- advanced short regional courses, with an international faculty
- creation of new structures.

One of the elements which stimulated the realization of our mission was actually the existence of a number of proposals for the second and third line of activity. In particular, for what concerns the latter, an updated version of one such proposal has been presented earlier today, as the Red Sea Institute (6). For what concerns activities in the second group, at the time of our mission were already in preparation the Dahab meeting and the first Symposium of this series.

Nobody doubts that the strengthening of Palestinian universities is a priority, but how it can really benefit of counting on international cooperation during a long period of time is a different matter. Additionally, I am afraid that for what concerns natural sciences, it might be unrealistic to believe that all these universities can be adequately equipped in the next few years.

The above comment on possible limits of the international cooperation does not exclude its great interest for the problem; in particular, at regional level, we found indeed that Israeli institutions showed interest and readiness to cooperate, and a similar deep interest was registered in Jordan.

Certainly these forms of cooperation must overcome psychological and political difficulties, linked to the traditional refusal of Arab scientists to collaborate with Israel (3), but in an international framework this seems achievable, as the experience of Dahab and of these Symposia are already showing, and as will certainly happen even more, if and when some of them are carried out in some Palestinian institution.

In practice, without excluding the first line of action, it seems that the second and third are preferable.

After our mission, we recommended that UNESCO sponsor the development in the region of a high level international institution of advanced study and research in natural sciences, including agriculture and engineering.

Clearly, the fact that the proposal of the Red Sea Institute has been presented here again today, and moreover accompanied by the question whether the Middle East is ready for such an endeavour, indicates that not much of what was considered two years ago did materialize.

This has to be attributed to the general political situation during this period. However, this situation is changing and further significant steps have been made along the path of the stabilization of the peace process. Therefore it is worth considering again the feasibility of a proposal of that sort and the goals one can achieve through its realization.

It is not my purpose to repeat here what Yavin and Sawafta have presented about the goals of their proposal, but instead I would like to limit myself to discuss two points, namely its feasibility and its connection with the other two modes of action.

Concerning the feasibility, I already stressed the interest of the international scientific community to cooperate. In the next few years, this interest will be certainly accompanied by that of the whole international community. The case of Central America indicates how, in modern world, the peace of a region is a matter of concern everywhere (at least when the region is of great strategical importance, as unfortunately some counterexamples could suggest). This implies that we can foresee the investment of huge international funds in this region for the keeping of the peace and for its development.

However, there are a few things that must be present in our minds: that this support will not last for ever, and that all financing agencies will want that it go preferably to sustainable actions.

This means, first, that even a high-cost investment, as it is needed if one wants to implement a permanent structure, may fit more easily in a long-term strategy, than the support, with a lower cost, to episodic actions of difficult, if not impossible, sustainability, second, and more important, that the time for this kind of initiatives is now.

In the same order of ideas, international scientific cooperation may find more attractive to be involved in some high-level regional activity than supporting, on a volunteer basis, one or more particular national institutions.

There are further aspects to be stressed in support of the idea of creating structures of the type of the Red Sea Institute. At regional level, and this was confirmed by some of the talks in this Symposium, it is easier to envisage multilateral than bilateral cooperation. This will make therefore possible for the Palestinian science to take advantage of the possibilities of cooperation offered by that of Israel, the most developed in the region, in a less complicated framework than if a bilateral cooperation is seeked.

Moreover, multilateral actions can more easily take advantage of the possibilities of cooperation of neutral potential partners, like could be the International Institute of Theoretical and Applied Physics (7) or some European universities.

In order not to be misunderstood, I want to make a further comment, deserved indeed by the problem of clarifying the role that the second line of activity I was mentioning would have, in case of an international commitment on the third one.

Then a reasonable balance should be found between the investment in big structures and the support of the short courses. In any case, this balance should be such that important experiences, which have proven to be extremely successful, like Dahab and these Symposia, may find an adequate location in a broad program.

Other elements suggest that indeed the modality of big structures may be one of the best available options: the Palestinian universities will receive a benefit from the multiplicative factor associated to the action of the Institute, with which obviously they will have a strong linkage; moreover, the cooperation with scientists from Israel and other countries of the region, in particular if the Institute will have an adequate component of applied science, will induce a strongly needed technological and economical development, which will abundantly pay off the investment made.

These elements constitute some of the feedbacks I was referring to at the beginning of my talk, as effects of the scientific development on the strengthening of the peace, made possible by the peace itself.

These ideas can only be implemented if the international cooperation plays the role it must in this endeavour. Since this project is to a large extent a megaproject, it is convenient to apply to it the considerations made by Tegart on the foresight phase of Megascience projects (8). The present stage of the project is the one in which it must be refined and include governments and international institutions in its planning.

This leads me to a few more comments. First that time is an essential parameter of this endeavour (9). The development of Science in this region cannot wait. Today we learned that last year, seventeen years after the peace, five hundred fifty fellows came to Israel from Egypt. In this case, if, as I hope, the general political conditions will allow the realization of the project, we must go faster.

Additionally, one must identify who may support such a project. The importance of the stability of the Middle East is recognised everywhere. This should lead to a serious possibility of support on part of United Nations, European Union and the United States, either through official bodies or agencies, or through academic institutions. I am certain that an institution like IITAP or one like the International Center of Theoretical Physics in Trieste, will support it, but one can also think to the possibility of cooperation of European networks of Universities, which could constitute consortia with the aim of collaborating with the new Institute. For this the experience of the ALFA program of network-oriented collaboration between Europe and Latin America (10) may provide a specially useful guideline.

Indeed, there have been already several manifestations of interest for these problems on part of European universities. Limiting myself to my personal experience, I shall just quote, as an example, far from being unique, the meeting convened last June by my University, that of Calabria, and coordinated by Ivo Slaus (from the Institute Ruder Boskovic in Zagreb), on “The role of Europe for scientific and technological cooperation, with special reference to Middle East and Eastern Europe”. Moreover, I can anticipate that preliminary contacts with the town of Cosenza and his mayor seem to indicate a definite interest of this town to be the venue of a meeting aimed to the formalization of the proposal of the Institute, basically according to the lines of the original proposal by Yavin and Sawafta (5), who suggested for that purpose Taba, in the border region between Egypt, Israel and Jordan. (Actually, this area was also proposed in their original paper as site for the Institute, whereas perhaps I would prefer to see it in Jericho or Gaza. Apart from the fact that this possibility was also considered in today’s presentation (6), I consider this a second-order problem and do not want to start a discussion on this point now).

How can this be done?

I still believe that what we recommended in the report of our 1995 mission (4) maintains much validity.

It is essential that the initiative counts on UNESCO’s support and, on the other hand, it fits nicely with the chart of this organization and its commitment and that of its Director General, for the diffusion of a Culture of Peace, which, as it was said today (1) must include Science for Peace.

According to our recommendation, UNESCO should:

1. adopt the goal of establishing in the Middle East an international institution of higher learning and research
2. take action to identify potential partners, within and outside the region
3. designate, as an immediate step, a high-level steering committee to plan the process for achieving this goal, with the necessary balance of Arab and Israelis, and some participation external to the region.

To these recommendations of two years ago, I would like today to add just one:

4. do all that soon.

As a final conclusion, I want to pay a tribute to a friend and teacher, who is no longer with us, but who certainly would have attended a Symposium like this and contributed with his outstanding scientific stature and long term vision of the need of supporting any action in favor of the scientific and technological development of developing countries, Abdus Salam.

Let me recall just two things. First of all, how he, Muslim, has been the advisor at Imperial College, of one of the most prestigious Israeli scientists, Yuval Ne’eman. Second, how he loved to recall that, centuries ago, Toledo was a town where joint work of Christian, Islamic and Jewish scholars was carried out harmoniously and in peace.

On his memory, let me express the hope that the Peace progress we are seeing in these days may lead this land to be a Toledo of the Third Millennium.

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The Eilat Statement on Science for Peace and on the Need to Develop a Regional Laboratory Network on Virus Diseases in the Middle East and Neighboring Countries

Members of the international scientific community of research on virus diseases met at the Inter-University Institute in Eilat 23-28 March 1997 to participate in the First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries. The Workshop was organized by the UNESCO-Hebrew University of Jerusalem International School for Molecular Biology and Microbiology with the motto “Science for Peace” and supported by UNESCO, Paris, UNESCO Venice Office, UNESCO-Global Network for Molecular and Cell Biology (MCBN) and the Hebrew University of Jerusalem.

The aims of the workshop:

1) to explore the state of research on virus diseases of human, animal, fish and plants by bringing together the scientists dealing with these virus diseases in the Middle East and neighboring countries;
2) to explore ways for regional cooperation on virus diseases since viruses move freely through man-made borders and
3) to explore the development of a Middle East Regional Network of virus laboratories to enhance the cooperation among scientists for the benefit of the peoples of the Middle East and the neighboring countries.

The participants of the Workshop accepted and supported the Jerusalem Statement on Science for Peace and its recommendations, which were accepted earlier by the participants of the Second International Symposium on Science for Peace (19-24 January 1997), to ensure that:

1) scientific endeavors and achievements be used only for peaceful purposes and for the greater benefit of humanity;
2) free movement of members of the Academic -scientific community;
3) free flow and sharing of scientific information and knowledge;
4) the academic environment remains open and dedicated to free expression of ideas.

In the Eilat Statement on Science for Peace the participants of the First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries recommend to Prof. Maurizio Iaccarino, Assistant Director General for Science, the UNESCO Science Sector UNESCO, Paris:

1) to support and develop a Regional Network of Virus Laboratories in the Middle East to enhance virus research by sharing information and by scientific cooperation for the benefit of the people in the region;
2) to establish a series of scientific workshops in the framework of the Regional Middle East Network to enhance participation of scientists from the region and from other countries to discuss and plan collaborative research projects;

These regional scientific activities supported by UNESCO will enhance the understanding between scientists and, consequently, the understanding between the peoples in the region.

D. THE UNESCO-HUJ ISMBM

Establishment, Activities and Plans of the UNESCO-Hebrew University of Jerusalem (HUJ) International School for Molecular Biology and Microbiology (ISMBM)

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Abstract

The UNESCO-HUJ ISMBM was established by an agreement between UNESCO and the Hebrew University of Jerusalem with the aims of developing an avant-garde school which will sponsor the cooperation between scientists working on the cutting edge of biological, chemical, and physical sciences, provide knowledge in molecular biology and microbiology to young scientists, encourage the prevention of the misuse of biological sciences, and contribute to Science for Peace and the Culture of Peace which is promoted by UNESCO. The International School has regional and international responsibilities in the promotion of scientific knowledge and Science for Peace concepts and activities.

The Path Leading to the Establishment of the International School

The path leading to the establishment of the UNESCO-HUJ ISMBM started in St. Petersburg, Russia in 1992. At the conference "Concepts in Virology" which was organized by Professors Demitri Lvov, Russia, and Brian Mahy, USA, I met Professor Raymond Daudel, President of the European Academy of Arts, Sciences and Humanities, Paris; Professor Luc Montagnier from the Pasteur Institute, Paris, and Dr. Vladimir Kouzminov, Chief of UNESCO Venice Office. At a later date in 1992 Professor R. Daudel invited me to become a member of the UNESCO Venice Office Research Network "Man Against Virus". On 6 February 1994, Professor Daudel invited me and my wife to Paris for a meeting to discuss my involvement in the "Man Against Virus" network. During lunch in the restaurant in the UNESCO building together with Professor Claude Rosenfeld, scientific adviser to the UNESCO Science Sector, and Prof. Daudel, Prof. Rosenfeld had asked me if I have a plan for UNESCO in the wake of the developing peace in the Middle East. My response was that the time had arrived to develop "a School for Molecular Biology and Microbiology for Peace" to support the scientists internationally and regionally to prevent the misuse of science. This idea excited Professors Rosenfeld and Daudel and we hurried to the Science Sector building to meet with Professor Adnan Badran, then Assistant Director General for Science. Professor Badran listened carefully to my idea, approved it and gave the green light to Professor Zharov, Director, Basic Science Division and Professor Rosenfeld to start with the arrangements to establish the UNESCO-HUJ ISMBM.

Soon after this meeting, another meeting took place on March 7, 1994 with the participation of Professor Angelo Azzi, Chairman of UNESCO Global Network for Molecular and Cell Biology (MCBN). In this meeting with Professors Badran, Zharov, Rosenfeld and Azzi the practical plans for the opening of the school's activities were discussed. During the visit of Professor A. Badran to the Institute of Microbiology and the Hebrew University on 26 April 1995, an agreement between UNESCO and the Hebrew University of Jerusalem (HUJ) to establish the International School for Molecular Biology and Microbiology (ISMBM) with the motto "Science for Peace" was signed by Professor A. Badran for UNESCO, Professor Y. Ben-Arieh, Rector, for the Hebrew University of Jerusalem and myself as Director of ISMBM. The UNESCO-HUJ ISMBM "will promote cooperation with universities at the regional and international levels and UNESCO, through MCBN network and other subprogrammes, will promote cooperation among scientists and institutions worldwide". The UNESCO-HUJ ISMBM aims to connect scientific and cultural activities of UNESCO with scientific activities in institutes and universities in the Middle East and around the world as indicated in the organization of UNESCO-HUJ ISMBM.

During the summer of 1995, I worked in the offices of Professor Vladimir Zharov at UNESCO, Paris, with his secretary Françoise Lee, to initiate the activities of the UNESCO-HUJ ISMBM and in December 1995, the Inauguration Ceremony of the International School took place at the HUJ campuses in Jerusalem followed by the First International Symposium on Science for Peace. These activities were followed by the First International Workshop on Computation in Molecular Biology at the Silicon Graphics Laboratory and a Workshop on Molecular Diagnosis of Microbial Agents.

In the years 1996-1997 the school hosted scientists from China and India, and arranged a UNESCO fellowship for a Palestinian student from Al-Azhar University in Gaza, Palestinian Authority to study for a M.Sc. in Microbiology and two Palestinian PhD students in Parasitology at HUJ. The Second International Symposium on Science for Peace was organized in Jerusalem 19-24 January 1997, followed by the Second International Computation Workshop in Molecular Biology. The First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries was organized in Eilat 23-28 March 1997 to discuss virus research in the context of Science for Peace and to plan ways to develop a Middle East Regional Scientific Cooperation Network System (MERSCNS).

The Science for Peace Symposia and Statements

In the two Science for Peace Symposia emphasis was given to regional an international subjects. The First Symposium which was organized with Professor Moshe Maoz, Director of Harry S. Truman Institute for the Advancement of Peace, the participants reviewed the Israeli-Palestinian collaborative research projects, attempting to resolve regional problems like the sharing of water resources, research on human diseases an human health. In the Second Symposium , the regional subjects dealt with the ideas to develop a regional university, sharing knowledge in combating human health problems in the Jordan Valley and in Gaza, Palestinian Authority, acceptance of a Palestinian student to the MSc program at the HUJ. The need to develop a Middle East regional scientific cooperation Network was also presented. In addition, the concept of Science for Peace was discussed as well as the contributions of biology to Science for Peace were analyzed. The subject of how to prevent the misuse of biology biotechnology and genetic engineering were discussed. The outcome of the discussions led to inclusion of biology as a subject in the Forum on “Nuclear and Biological Decommissioning: Management of Global Security Threat” which is organized by the Landau Network Coordination Center at Centro “A. Volta”, Villa Olmo, Como, Italy, and UNESCO Venice Office, 27-28 June, 1997.

Scientific Activities of the UNESCO-HUJ ISMBM and Plans

In the 1998-1999 period the plan is to prepare the Third International Symposium on Science for Peace in Jerusalem. In the programme additional subjects will be included to review the roles of Medicine for Peace, Chemistry for Peace as well as the question of how to use the information superhighways on the internet to promote Science for Peace activities like the “Science for Peace Oath” for young scientists. Based on the ideas to develop a regional university and a Middle East Regional Scientific Cooperation Network aspects of the organization and the concepts that should be developed will be discussed. The subject o prevention of the misuse of biological sciences an the elimination of the biological weapons will be one of the subjects. The role of new economic approaches to support Science for Peace in a world where capitalism is the only economic theory.

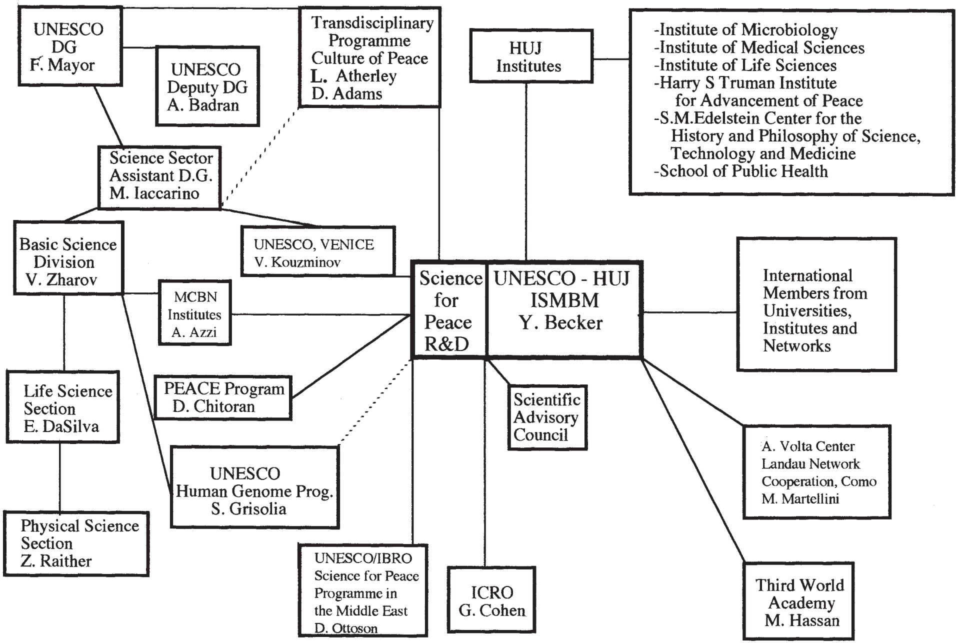
Scientific workshops on microbial diseases of humans, animals, and plants in the Middle East and Neighboring Countries are planned to sport the development of the Scientific Network described in the Eilat Statement on Science for Peace.

The information on the UNESCO - HUJ ISMBM is on the internet at the site:

http://www.tau.ac.il/~becker/UNESCO-HUJ/ismbm.html

With the home page we plan to actively involve scientists in the development of “Science for Peace” concepts and in the implementation of the “Science for Peace Oath” in institutions of higher learning internationally.

Organization of UNESCO-HUJ ISMBM



ADDENDUM

ACTIVITIES OF UNESCO-HUJ ISMBM

26 April 1995	Signing of the agreement between UNESCO and HUJ
11 Dec. 1995	Inauguration ceremony of the UNESCO-HUJ ISMBM, Jerusalem
11 Dec. 1995	Membership in the UNESCO Global Network for Molecular and Cellular Biology
11 Dec. 1995	The First International Symposium on Science for Peace, Jerusalem
12 Dec. 1995	The First International Symposium on "Molecular Biology and Microbiology in the Frontiers of Biological and Medical Sciences
13-14 Dec. 1995	Workshop on "Computational Sequence and Structure Analysis of Biomolecules", Jerusalem
14 Dec. 1995	Workshop on PCR in Molecular Biology and Microbiology
19 March 1996	Workshop on Microbial Diseases with a group of microbiologists from the Citizen Ambassadors of America
11 August 1996 - 10 Sept. 1996	Visit of Professor Qi Yipeng from Wuhan University Wuhan, P. R. China
24 Oct. 1996	Cooperation agreement with the Landau Network Coordination Centre at the Alessandro Volta Centre for Scientific Culture
8-14 Dec. 1996	Visit of Prof. Obeid Siddiqi, National Center for Biological Sciences, Tata Institute of Fundamental Research, Bombay, India
20-23 Jan. 1997	The Second International Symposium on Science for Peace
2-10 Feb. 1997	The Second Workshop on Computation in Molecular Biology, Jerusalem
23-28 Mar. 1997	The First International Workshop on Virus Diseases of Humans, Animals, Fish and Plants in the Middle East and Neighboring Countries, Eilat

Second International Symposium on Science for Peace

20-23 January 1997, Jerusalem, Israel

Final Programme

Sunday: 19/1/97

	Arrivals at Park Plaza Hotel, Jerusalem
20:00	Committees meetings at the Hotel

Monday: 20/1/97

	The Belgium House, the Library, Givat Ram Campus, HUJ
09:30 - 10:30	*Symposium Opening Ceremony*
Chair	*H. Gutfreund, V. Kouzminov, Y. Becker*
Greetings by	H. Gutfreund, President HUJ, Jerusalem
	E. Katzir, The Weizmann Institute, Rehovot
	T. Forstenzer, UNESCO Paris
	V. Kouzminov, UNESCO Venice Office
	D. Adams, UNESCO Interdisciplinary Programme on Culture of Peace, UNESCO, Paris
	M. Nalécz, Collaborating Centre for Research and Training in Biocybernetics and Biomedical Engineering, Warsaw, Poland
	J. Vary, International Institute for Theoretical and Applied Physics, Iowa State University, Ames, Iowa, USA
	I. Khalatnikov, President, Landau Network, Como, Italy
	M. Yaari, The Open University, Tel-Aviv, Israel
	D. Harari, Secretary General, Israel Committee for UNESCO
10:30 - 11:00	Coffee Break

Session 1:	**Science for Peace**
Chair	*I. Khalatnikov, G. Violini*
11:00 - 11:30	A. Keynan and D. Shoham (Israel): Scientific Cooperation and Conflict Resolution
11:30 - 12:00	M. Yaari (Israel): The Open University Contributing to Science for Peace
12:00 - 12:30	R. Pundak (Israel): Roots and Crystallization of the Oslo Peace Process
12:30 - 13:00	T. Forstenzer (UNESCO): The Contributions of UNESCO to Science for Peace
13:00 - 15:00	Lunch break
Session 2	**Initiatives of Science for Peace (I)**
Chair	*J. Vary, R. Sawafta*
15:00 - 15:30	Y. Becker (Israel): The UNESCO-HUJ ISMBM and The Jerusalem Statement on Science for Peace
15:30 - 16:00	A. Yavin (Israel): Is the Middle East Ready for a Regional University? R. Swafta (Palestinian Authority & USA): A University Central to the Region
16:00 - 16:30	J. Vary (USA): International Cooperation in the Physical Sciences for Peace
16:30 - 17:00	Coffee break
17:00 - 17:30	M. Martellini (Italy): The Landau Network: A Contribution to Science for Peace
17:30 - 18:00	G. Violini (Italy): Science and Peace in the Middle East, Proposal for an Agenda
18:00 - 19:00	Discussion
Evening	
19:00	*Reception at Beit Belgia, HUJ, Givat Ram Science Campus*

Tuesday 21/1/97

Session 3	**Contributions of Biological Sciences to Peace (I)**
Chair	*E. Katzir, K. Aultman, A. Keynan*
09:30 - 10:15	E. Katzir (Israel): Importance of Modern Biotechnology in Promoting Peace
10:15 - 10:45	Y. Margalith (Israel), & J. Safi (Palestinian Authority): Regional Scientific Cooperation on Solutions to Environmental Problems Caused by Arthropods in the Jordan Rift Valley and the Gaza Strip
10:45 - 11:15	A. Falaschi (Italy): Biotechnology and Peace
11:15 - 11:30	Coffee break
11:30 - 12:00	Prof. Seri Nusseiba: Meeting of Minds
12:00 - 12:30	K. S. Aultman (USA) : Science for Peace in the Middle East: Cooperation on Basic Research as a Means to Foster Peace.

Session 4	**Contributions of Economic Science to Peace**
Chair	*M. Martellini, A. Falaschi*
12:30 - 13:00	C. Passera (Italy): Capitalism for Peace
13:00 - 15:00	Lunch break

Session 5	**Philosophy of Sciences and the Culture of Peace**
Chair	*D. Adams, M. Ramirez*
15:00 - 15:30	S. Schweber (USA): The Moral Responsibility of the Scientist: Hans Bethe and Nuclear Weapons
15:30 - 16:00	A. Kasher (Israel): Ethical Guidelines for Scientific Research
16:00 - 16:30	Discussion
16:30 - 17:00	Coffee break
17:00 - 17:30	M. Martellini (Italy): The Origin of Life as the Emergence of a Planck-like Quantum Distribution
17:30 - 18:00	Discussion

18:00 - 19:00	M. Ramirez (Spain), J. Vary (USA) Committee Meeting on The Jerusalem Statement on Science for Peace
Evening	Free Evening / committees meeting

Wednesday 22/1/97

Session 6	**Prevention of the Misuse of Science**
Chair	*K. Berns, V. Kouzminov*
09:30 - 10:00	K. Berns (USA): Protection of Microbiology and Biotechnology against Misuse: Efforts of American Society for Microbiology to Control Biological Weapons
10:00 - 10:30	V. Kouzminov (UNESCO): UNESCO Venice Office and the Program in Science for Peace
10:30 - 11:00	S. Romahi (Jordan): The Role of Science in Promoting Peace: Middle East Foundation for Education and Science
11:00 - 11:30	Coffee break
11:30 - 12:00	Jonathan Levy (USA): Biological Warfare: an Ethical Conflict
12:00 - 12:30	M. Ramirez (Spain), J. Vary (USA): The Jerusalem Statement on Science for Peace
12:30 - 13:00	Discussion
13:00 - 14:00	Lunch break
14:00 - 15:00	Tour of The National Library, Givat Ram Science Campus

Session 7	**Contributions of Physics and Technological Sciences to Peace**
Chair	*S. Romahi, J. Vary*
15:00 - 15:30	J. Shinar (USA); Topics in Applied Physics and their Implementation in Jordan Valley / Red Sea Academic Institute

15:30 - 15:45	M. Hasan (Jordan): The Evolution of Physics Teaching in the West Bank and Jordan
15:45 - 16:00	A. Al Nasser Al Hawajri (Palestinian Authority): From Al Azhar University, Gaza, to the Institute of Microbiology of the Hebrew University of Jerusalem
16:00 - 16:30	R. Sawafta (USA): International Scientific Cooperation in Science
16:30 - 17:00	Coffee break
17:00 - 18:00	Committees meetings
Evening	Free Evening / Special Session - Physics (at Park Plaza Hotel) organized by J. Vary

Thursday 23/1/97

Session 8	**Science for Peace in the Context of Culture of Peace**
Chair	*S. Schweber, T. Forstenzer*
09:30 - 10:00	M. Ramirez (Spain) & D. Adams (UNESCO): Peace is Scientifically Possible: From The Seville Statement on Violence to the UNESCO Culture of Peace
10:00 - 10:30	D. Adams (UNESCO) The Culture of Peace and the Culture of Science
10:30 - 11:00	Discussion
11:00 - 11:30	Coffee break

Session 9	**Contribution of Biological Sciences to Peace (II)**
Chair	*J. Orfila, Y. Becker*
11:30 - 12:00	J. Orfila (France): Studies on Chlamydia in Tunisia and Morocco
12:00 - 12:15	I. Schenker (Israel): HIV / AIDS as a Uniting Factor in the Middle East
12:15 - 12:45	Y. Becker (Israel): A Proposal for a Middle East

	Regional Network on Virus Diagnosis and Eradication
12:45 - 13:15	Discussion
13:15 - 15:30	Lunch break
Session 10	**Initiatives of Science for Peace (II)**
Chair	*T. Forstenzer*
15:30 - 16:00	A. Slifka (USA): Abraham Fund and its Mission
Session 11	**Round Table and General Discussion**
Chair	*D. Adams, M. Ramirez*
16:00 - 17:00	1) Prevention of Misuse of Science Discussants: J. Vary, K. Berns 2) Contributions of Science for Peace to Culture of Peace Discussants: A. Keynan 3) The Jerusalem Statement on Science for Peace - the Next Step. Discussants: M. Ramirez, J. Vary
17:00 - 17:30	Coffee break
Session 12	**Closing of the Symposium on Science for Peace**
Chair	*D. Adams, J. Vary, Y. Becker*
17:30 - 18:30	Summaries
20:30	Farewell Dinner Final Discussion of the Jerusalem Statement on Science for Peace and Approval

Friday 24/1/97

Departures

List of Participants

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