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THE UDAIPUR CONFERENCE

The twelfth Pugwash Conference was held at Udaipur from 27th January to 1st February, 1964. It was attended by 56 participants and 10 observers from 25 countries. All members of the Conference were accommodated in the Lake' Palace Hotel where all the meetings were also held. The hotel was until recently a Maharana's Palace and stands on an island in the middle of a lake. Its exotic splendour and luxury far exceeded anything the Pugwash Conferences have experienced to date. In addition, the Indian Organizing Committee, with Professor Vikram Sarabhai as the prime mover, prepared a spectacular social programme which included an excursion to old temples, classical dances and music, folk dances and receptions. All these entertainments did not, however,

distract the participants from their main task and everybody worked hard to complete the programme; the final plenary session lasted from 2 to 9.35 p.m.! Many valuable suggestions, particularly on the role of science and technology in developing nations, were put forward and summarized in the Statement. Much was also learned on other problems which will be useful in the planning of future Conferences.

All Conference papers, as well as the main points made in the discussions, will be included in the Proceedings which will be issued in the near future. Meanwhile we print below the text of the Statement issued by the Conference and the Report of Working Group 4. Both these documents may be reprinted without asking for permission.

STATEMENT

from the 12th Pugwash Conference on Science
and World Affairs

A. Disarmament and Measures for Collective Security

We have reviewed recent progress in the reduction of tensions and the limitations of armaments. We have noted with satisfaction the agreement between the governments of the U. S. S. R. and the U. S. A. not to orbit objects with nuclear weapons, and the decisions of these Governments to reduce their military budgets - events which have occurred since our last meeting. Nevertheless, we are still faced with the central problem of achieving concrete and substantial measures of disarmament by the great powers.

We recognize that the Moscow Test Ban Treaty of 5th August, 1963,

is a significant step towards general and complete disarmament and the course of events since then has justified the hopeful expectations it has created.

We believe that the adoption, in particular by the nuclear powers, of balanced measures requiring no control, by way of the policy of mutual example, would make a valuable contribution to the restriction of the arms race, and the improvement of the international atmosphere. Such measures should include the further reduction of military budgets and of armed forces, withdrawals of troops on foreign soil and closing of foreign military bases.

We recommend that an agreement be reached, along the lines of the

proposal made in the letter of Chairman Khrushchev of 31st December, 1963 and the response of President Johnson of 20th January, 1964, which would reaffirm the obligations of the U.N. Charter and prohibit the use of force in settling any territorial dispute or question of frontiers.

The Moscow Test Ban Treaty has made the acquisition of nuclear weapons capability by other nations less likely. At the same time it places on the two major nuclear powers, who continue to maintain nuclear weapons, a heavy responsibility to give ever increasing content to the policy of peaceful co-existence so that they may with full effect make their contribution to safeguarding international security. It is, therefore, essential to strengthen the U.N. system for safeguarding the security of weaker nations, by cooperation of the U.S.A. and U.S.S.R. who should assume special responsibility for this purpose within the framework of the U.N. To the extent that such a guarantee of security and territorial integrity of all nations, particularly of the non-aligned nations, becomes effective, it would stimulate reductions in the armaments of non-nuclear nations, thereby releasing resources for advancing their economic progress. It would also facilitate further steps towards general and complete disarmament.

In view of the continuing dangers of the spread of nuclear weapons and delivery systems, we believe the following additional measures to be necessary: (1) all nations presently possessing nuclear weapons should jointly undertake not to transfer these weapons or technical information relating to them to any other state or group of states; (2) all

nations not possessing nuclear weapons should undertake not to produce such weapons, nor to acquire them or the special technical information necessary for their production; (3) the government of each of the nuclear powers should take whatever measures may be open to it to prevent its nationals with experience in the field of nuclear weapons technology from contributing to the development of the nuclear weapons capacity of any foreign power.

The concept of a nuclear umbrella, or minimum deterrent force, which we have been discussing in our Conferences since 1960, to be maintained by the two great nuclear powers during the process of general and complete disarmament, is of major importance in providing the necessary guarantee against aggression by hidden weapons. We welcome the proposal of the U.S.S.R. to extend it to the end of the disarmament process. We regard the possibility of agreement on the principles of a nuclear umbrella, or minimum deterrent force, to offer one of the most helpful avenues to reach agreement on comprehensive disarmament under effective controls.

In the long run we must realize that disarmament will be neither general nor complete unless all nations, including the People's Republic of China, adhere to the agreements. Wholehearted adherence of the People's Republic of China will be made more likely if she is brought into the disarmament deliberations soon. In view of this, we urge that steps be taken which will make it possible for her to participate in the discussions and to take her place as a member of the United Nations family.

B. The Relation Between the Economic Problems of Developing Nations and World Security

We have also discussed the relation between the economic problems of the developing nations and world security.

The two problems facing mankind today are the achievement of disarmament and the elimination of poverty. Both are of special concern to scientists. It is the advance of science which has opened up the vast possibilities of destruction that lie before us today. Both require for their solution a new sense of international responsibility; members of each nation must acknowledge that their fate is bound up with the security and prosperity of the members of all other nations.

The conclusion of an agreement on general and complete disarmament would make it possible for advanced nations to divert large resources to the development of developing nations. For example, an increase in aid by an amount equivalent to even one-fourth or one-fifth of the total saving in military expenditure, as a consequence of general and complete disarmament, could, if accompanied by good planning and implementation of programmes for development, be expected roughly to double the present rate of economic growth of the underdeveloped countries.

But the promise of more aid at the time of disarmament must not be an excuse for not giving more aid now. In the light of recent events, when some cuts in military expenditure were not accompanied by increased aid, we strongly feel that it would help to remove misapprehensions and provide reassurance,

if the leaders of the advanced nations were to reaffirm now their intention to divert to the developing countries as high a proportion as possible of the resources released by disarmament. Economic aid should not be linked to military and political conditions.

Disarmament in the developing countries themselves would release resources for development. The armed forces of the developing nations, like those of the advanced nations, would be reduced to the minimum level necessary to maintain law and order.

There are several ways in which a start might be made upon greater international co-operation now. The advanced nations may contribute jointly to capital funds, they may work jointly on major projects (e. g. dams) in the developing nations, and they may send joint teams of experts. We urge that these teams, wherever practically advisable, should have a truly international composition not only in the top administration, but also in the field.

The trading position of the developing countries has suffered gravely from the deterioration in their terms of trade over the past decade. Moreover, as they develop they will require increasing markets in the advanced countries for semi-manufactures and finished manufactures, which they will be able to supply in addition to primary products. The advanced countries can greatly help the developing countries through trade. We welcome the United Nations Conference on Trade and Development, which is going to tackle these problems, and we hope that participation will be open to all

nations regardless whether or not they are members of the United Nations. We particularly welcome any measures which promote trade and economic co-operation between East and West.

C. Science and Technology for Developing Countries

Modern science and technology have provided the instruments that could lead to a brilliant future for mankind. But the brutal fact is that half the human race lives in misery and degradation. The economic gap between the advanced and the developing countries is widening. If this gap is allowed to grow, as it must in the absence of substantial aid, it is bound to threaten world peace and security.

The hope of solving the problems of poverty depends, above all, on men learning to work together. How shall we make wise international investments for the creation of a better world? How can we produce in the poor countries a sufficient and growing number of well qualified scientists and engineers? How can we improve education at all levels? What is the best way to prevent the loss of scientists from the poor countries to the rich ones?

Assistance by the more prosperous countries to the developing nations is an investment in a better world. To be effective, it needs to be long continued and maintained at a much higher level than at present. Allocations for assistance should be independent of any measures of disarmament, but it is manifest that substantial progress in disarmament could release great resources, a considerable fraction of which could be devoted to raising the productive capacities of the newly developing countries. This would be a modern version of beating swords into ploughshares.

Generally, we would like to see an ever widening degree of internationalism in economic relations, including co-operative planning for the development of the world's resources.

In the common interest of all nations, aid to developing countries must be removed from the context of the cold war. There are two principal means of doing this and we urge statesmen to explore both. One is through the multilateral agencies (though we believe both bilateral and multilateral aid will continue to be needed), the other is through common enterprises in which East and West collaborate in carrying out large development projects - for example, a joint attack on the salinity problem in the Punjab.

Advances in science and technology are even now opening up new resources of wealth outside the jurisdiction of national states. We suggest that now, while the situation is still in flux, the question be explored of giving U. N. jurisdiction over outer space, the oceans outside recognized national jurisdiction, and Antarctica; this jurisdiction to include exclusive rights to regulate activities in these areas, for the benefit of the developing countries.

All past experience in the advanced countries shows that the return on investments in research, both pure and applied, can be very high, indeed higher than in almost any other areas.

We believe that similar investments in the developing countries will yield similar returns. Such investments should be limited only by the availability of persons competent to undertake the work, and these investments should be rapidly increased year by year until they reach the order of 2-3 percent of the gross national product.

Each nation should undertake those kinds of research which are most important for its development and which it can best do. Each region of the world offers particular opportunities and every nation can contribute to world science. For the most part research in developing nations, as in others, should be applied. Local problems involving the economic development of the nation should be identified and explored. These problems will range from those of basic geology and geophysics to plant physiology and genetics, and from the economics of development to the sociology and biology of human reproduction.

Developing nations, like the more advanced ones, are faced with the double task of engaging in research necessary for their economic growth and at the same time of training expanding numbers of competent research workers. Research institutes formed for the purpose of expediting research in specialized areas should be closely connected with the universities. The leading research personnel should teach in the universities, and graduate students should be encouraged to conduct their research in the institutes.

Universities anywhere, but especially in developing countries, cannot hope to be excellent in all fields. Initially, each university in a developing country should concentrate on a few areas for research, and training in research, which are particularly important to that country. Interchange of staff and research students with universities in the advanced countries should be encouraged by every possible means. To be truly effective, such co-operation between universities must go far beyond what has happened in the past. The developing countries have great opportunities to become leaders in many fields of the social

and natural sciences, where they can offer unique facilities for research.

Scientists and engineers of East and West can work together on scientific problems of development. For example, research is required on soil-salinity control in the Indus plains of India and Pakistan. Soil scientists from the U. S. S. R. and U. S. A. could gain valuable insights and mutual understanding by working together on this critical problem. Means must particularly be sought through the international scientific unions, and in other ways, to help individual scientists from the rich and poor countries to work together.

The formation of international youth teams, possibly under the auspices of the United Nations, in which young specialists and technicians from East and West, North and South, could work together on specific projects under the supervision of senior experts could also be useful. Possible examples are health teams and geological survey teams.

The disparity in the conditions of work, in status, and in salaries, between scientists in the developing and the advanced countries must be reduced. This would be the best way to avoid the tragic loss of many of the ablest and best trained young men from the poor countries.

A scientific attitude must pervade the whole of the educational process in the schools. The methods of teaching science in the developing countries can be greatly improved by the use of new teaching techniques and by continued research in ways of better teaching.

In the development process, the stage of identifying and analysing the major problems of a country or region will almost always involve a multi-disciplinary approach, in which engineers, agronomists, operational analysts, natural scientists, sociologists, economists, specialists in public administration, and humanists concerned with the traditions and the values of the people, must all work together. A good analysis is the least expensive step in the development process; yet it can multiply many-fold the effectiveness of large development expenditures. If the analysis is to be acceptable to the developing country, its representatives must participate in organizing the analysis. For these and other reasons, the stage of analysis is one in which the U. N. agencies can play an essential role.

We recommend the establishment within the United Nations family of a semi-autonomous institute or commission for resources analyses. Its members would be those nations which wish to co-operate in making or using multi-disciplinary analyses of development problems. Its programmes would be worked out and approved by conferences of the member states. But the work would be paid for by the countries in which the analytical teams were situated and by other countries interested in the problem. Thus, the budget of the institute itself could be relatively small. One of its essential functions would be the training of teams from the developing countries in the methods of analysis and data interpretation.

We suggest that UNESCO should play an important role in establishing and sponsoring the new organization, but other

specialized agencies of the United Nations should also be intimately involved.

To strengthen UNESCO for its newly assumed tasks of helping to apply science and technology for development, the National Commissions for UNESCO in each member country should contain many more natural and social scientists and engineers. National liaison agencies with UNESCO should include those concerned with science and technology as well as the ministries of education.

We believe that a semi-autonomous world health research centre under the sponsorship of the World Health Organization could be useful to the developing countries if its field operations included support of and collaboration with existing research laboratories in those countries, and the establishment of regional laboratories for specific needs such as the study of tropical communicable disease.

The developing countries have experienced great difficulties in obtaining trustworthy and sufficiently complete technical information on industrial processes and the design of machinery and plants for industry. We urge the U. N. and the specialized agencies to do much more towards developing industrial consulting services, reference - collections of technological information, and a central exchange to publicize the needs in the developing countries for specific technical and industrial knowledge.

Studies on an international scale should be undertaken on the problems of population growth and its impact on economic development.

12TH PUGWASH CONFERENCE
ON SCIENCE AND WORLD AFFAIRS
Udaipur, 27th January - 1st February 1964

Report of Working Group 4

SCIENCE AND TECHNOLOGY IN DEVELOPING NATIONS

1. INTRODUCTION

It is widely recognized that modern science and technology are transforming the conditions of human life and providing the instrument for ensuring a brilliant future for all mankind. Nevertheless, the brutal fact is the misery and degradation of half the human race. The economic gap between most of the so called "developed" and "developing" nations is rapidly widening; if it is allowed to grow, as it must in the absence of substantial aid from the developed to the developing nations, it is bound to lead to a situation of great political instability, and to constitute a threat to world peace and security. Now is the time to institute a massive programme of aid; the longer it is delayed the greater the ensuing dangers and the larger the eventual cost. To be effective, the amount of aid needs to exceed a critical value, for otherwise it fails to excite a creative response from the population it is designed to help, and only the creative efforts of a people can, in the long run, build up a country on a sound basis.

The hope of solving these problems depends, above all, on men working together. We must find the best ways

of increasing the effectiveness of international co-operation all over the world. It is reasonable to advocate it because there is an overriding common interest between states East and West, North and South, that it should be established. We believe that all existing institutions for co-operation are useful, but that many of them can be strengthened and improved, and some new kinds may need to be devised.

It is of urgent importance, however, that these problems should now be approached in a concrete and detailed way. Past errors in the employment of aid must be distinguished and corrected, new approaches to old problems must be found.

How to make international investments in development for the creation of a better world? How to produce, in poor countries, a sufficient and growing number of well-qualified scientists and technicians? How to organize higher education? How to prevent the loss of scientists from poor countries to rich countries? How to improve agriculture and food production? It is with such questions that we have been principally concerned. A summary of our main suggestions and recommendations is appended.

2. INTERNATIONAL INVESTMENT IN A BETTER WORLD

Assistance by the more prosperous countries to the developing nations is an investment in a better world. In the past, help for the advancement of science and technology in new countries has been sporadic; if it is to be effective, it needs to be long-continued and on a much greater scale than before. The problems are grave and urgent, and sufficient funds ought to be made available to ensure quick action. We suggest that each developed country might undertake to contribute about 1% of its gross national product per annum, of which about 5% should be devoted to the promotion of science and technology in the developing countries, including the sums involved in training personnel.

This allocation should be independent of any measure of disarmament, but it is manifest that substantial progress in disarmament could release great resources, a considerable fraction of which should be devoted to raising the productive capacities of the newly developing countries. This would represent the modern version of 'beating swords into ploughshares'.

All forms of assistance are required; bilateral, such as direct aid by an advanced country to a developing country; and multilateral, through the U. N. and its specialized agencies for example, or through regional and other multilateral agencies.

Effective aid for strengthening science and technology in the developing countries requires, however, more than financial resources. It also depends on the availability of large numbers of competent people. The scientific communi-

ties in the developed countries should pay attention to this need through their own professional societies, so that a feeling of personal responsibility amongst scientists and educators may be encouraged. The scientific societies should be urged to set up committees to advise and assist the various national and international agencies which are concerned with and, particularly those involved in the recruitment of personnel. All countries, in planning the education of their own scientists and technologists, should also, where feasible, make provision for training extra personnel to help other countries.

Today the assistance which the U. N. and its specialized agencies can give to developing nations is limited by the extent of financial contributions from member states. As a long term aim it appears, therefore, desirable to add to such contributions. We suggest that independent direct sources of revenue should be made available for the U. N. Science and technology are already opening up new sources of wealth which are largely outside the jurisdiction of national states and which have hitherto not been made sources of revenue by national taxing authorities. We have in mind, for example, space-traffic and space-communications; the resources of the oceans outside the limits of national jurisdiction, including minerals on the ocean bottom; and the potential resources of Antarctica. We suggest that now, while the situation is still fluid, the question should be explored of giving the U. N., by treaty, jurisdiction over outer-space, the oceans outside recognized national jurisdiction, and Antarctica. This jurisdiction should, we suggest, include exclusive rights to

regulate and to tax wealth-producing activities from such sources.

It is in the common interest of all nations to remove aid to developing countries from the context of the cold war. There are two principal means of doing this both of which we urge statesmen to explore. One is by an agreement to allocate an increasing share of aid for development through the multilateral agencies, though we believe both bilateral and multilateral aid will continue to be needed. The other is through common enterprises in which both East and West collaborate with newly advancing states in carrying out large development pro-

jects, particular examples of which we mention later.

Co-operation between East and West in development should be based on certain agreed principles. First, it should be recognized by all states that there is more than one feasible road in development, and that the choice must be left to each developing country, acting through its own political processes without coercion either military, political or economic, and free from interference from outside. Secondly, all assistance should respect and promote the political, economic and cultural independence of the recipient countries.

3. EDUCATION AND RESEARCH

Investment in man is vital to all development. It is especially important to prepare adequate numbers of well qualified educators, scientists, technologists and technicians, for their availability commonly limits the pace of economic and social development.

The education of such men must be given a very high priority in any developing country. This proposition has been generally accepted, but differences of opinion exist as to the best way of implementing it, and mistakes have been made by all countries. We have discussed both what should be done in the developing countries and also how the more highly developed countries can assist them. We suggest that the following points should receive special attention:-

3.1 Education in Schools

The basic ideas of science and technology and the scientific attitude must

pervade the whole of the educational process in the schools. All children must be made to appreciate the importance of science and technology for the welfare of their country, even though many of them will find their careers in other fields. Care must be taken to emphasize the importance of applied as well as pure science. A proper balance should be encouraged between the numbers of students becoming technologists and technicians and those going into academic science. It must be remembered that research, development, and industrialization cannot be carried out without sufficient technical staff; adequate provision must, therefore, be made for technical schools.

The methods of teaching science, and consequently the training of science teachers, in the developing countries could be greatly improved by taking advantage of the new techniques now being investigated in the more highly developed countries. The work of UNESCO on new text-books for the less

developed countries is very commendable and should be extended.

3.2. Significance of Research

Developing nations, like those more advanced, are faced with the double task of educating rapidly an increasing number of teachers, scientists and technicians, and of engaging in research, particularly those kinds of investigation important for the development of the economy of the country.

All past experience in the advanced countries shows that the return on investment in research, both pure and applied, can be very high. Indeed it is commonly higher than in almost every other field of activity. Recent studies suggest that in Japan, for example, the return on investment in agricultural research and education has been at least 35% per annum for a period of several decades. In the United States it has been even greater.

We believe that substantial investment in the developing countries will yield similar returns. Indeed, we are of the opinion that the scale of such expenditure including that for the support of current research, the creation of new institutions and facilities, and the training of increasing numbers of educators, scientists and engineers, should be limited only by the availability of people competent to undertake the work. They are at present few in number and their abilities should be utilized with the maximum effect. Their social standing, conditions of work and salary, should be high enough to attract and retain people from among the most competent in the country, and should make it possible for them to devote their full time to teaching and research. They should be adequately provided with all

tools of their trade, such as laboratories, offices, libraries and equipment, and facilities for travelling to national and international scientific meetings. The leading scientists and technologists should be brought into the highest councils of state in planning the future development of a country.

Because of its essential contribution to a country's rapid advance, resources allocated to research and development, and to graduate education, should be increased each year - again by an amount limited only by the availability of adequately trained manpower. The rate of increase of expenditure will vary from country to country, but it can be very rapid. Japan, for example, has been doubling her expenditure of this kind every two or three years, and in the U. S. S. R. also the increases every year are very considerable. We believe that rapid rates of increase should be maintained until the expenditures on research, development and graduate education reach the order of 2 - 3% of the gross national product.

3.3. Character of Research in Developing Countries

In the research effort of a developing country, particular attention at the post-graduate level should initially be concentrated on a limited number of those disciplines which are of vital importance to it, and which it is best equipped to carry out. Every region of the world offers special opportunities for investigation and every nation can contribute to world science. For the most part, research in developing nations, as in others, should be applied. It is important, however, that basic research which is not aimed at the solution of any immediate practical problem should be given adequate support. While the fraction of the total effort spent upon basic research will vary from country to country, it should in

general be maintained at a level of about 20% of the total research expenditures, excluding development.

In a country's research effort, a broad spectrum of problems should, therefore, be considered. In the early stages a substantial effort should be made to survey natural resources and to analyse problems involved in their efficient exploitation. Problems will range from those of basic geology and geophysics to plant physiology and genetics; and from the economics of development to the sociology and biology of human reproduction. In the long term, all fields of knowledge should, in principle, be explored; none should be excluded. But research in areas which require a very large capital expenditure for equipment and a large number of highly qualified scientific personnel, such as high-energy physics, should be undertaken only if it can be pursued without seriously hampering the effort in other fields.

The research and development programme of an advancing nation requires central guidance from a Research Council or Academy empowered to allocate funds for research. It is important that this central body should be guided primarily by scientists and engineers rather than by persons who are unfamiliar with scientific research and the conditions in which it is best conducted.

3.4 Universities, Technical Colleges and Research Institutes

The importance of research for the life and vitality of Universities is generally recognized and this implies that a substantial fraction of the research effort of a country should be carried out in them. Many developing countries, however, will also need to

create first-rate institutes for research in agriculture, medicine, natural resources, social sciences and special technologies appropriate to their industrial development. Care must be taken to maintain a proper balance between the proportion of first-class men in these institutes and in the universities. Close co-operation rather than competition must exist between research institutes and the corresponding departments in the universities. This can best be achieved by careful siting of the institutes near universities, joint appointments and exchange of staff and research students. The close integration of the research institutes with the universities is vital. Just as research is an essential adjunct to good teaching in a university, so teaching and the contact with fresh young minds is essential to prevent research institutes from becoming stale and sterile.

3.5 Assistance from Universities in the advanced countries

Interchange of staff, and even of research students, with universities in the more advanced countries should be encouraged by every possible means, especially in those fields of investigation important for the advance of a developing country. To be really effective such co-operation must go far beyond what has been done in the past. In many fields, opportunities for research in the under-developed countries are so great that individual professors accompanied by their research students could profitably spend a few years in the universities of a developing country, transporting equipment and key technicians to establish working laboratories in which students and technicians can be trained. Faculty members and students from the developing country would make extended visits to universities in advanced countries not only to gain experience in

special fields but also to enrich the teaching and research in that university.

The corresponding research institutes in the more advanced countries can also help the developing countries by taking men for periods of a few months, for training in a new technique for example; or for one or two years in order to complete an investigation. This is one of the easiest and the most profitable ways of increasing the experience and self-confidence among the staffs of the research institutes in the developing countries.

3.6 Co-operative Research

A method for co-operation between scientists in different laboratories has been used successfully in France, Czecho-Slovakia and other countries, and might be applied on an international scale. A substantial scientific problem is selected by a scientific committee from a number of problems suggested by competent scientists. The selected problem may require three to five years work and a variety of techniques for its solution. A convener is nominated who asks selected scientists to join a working-group, and no pressure is applied. In a sense this working-group forms a decentralized institute, each participant doing the research in his own laboratory. The group as a whole decides on the programme and the distribution of tasks and meets regularly twice a year for progress reports and detailed planning of activities for the next six months.

Except for the small funds required the scheme depends almost entirely on the scientific community and does not require governmental agreement.

3.7 The Emigration of Scientists

There is a considerable danger

that developing countries may lose many of their able scientists, by emigration to the more highly developed countries, especially among those who go abroad for training in research. While it might be possible to stop this by legislation, we believe that the following actions are to be preferred:

- (a) scientists should usually be sent abroad for training in a specific field important for their country; and should be guaranteed a suitable position on their return;
- (b) fashions in research in the more highly developed countries should not be allowed unduly to influence countries with limited resources;
- (c) attempts should be made to reduce the gap in the conditions of work between the scientists in rich and poor countries, especially for the really outstanding young men.

3.8 Role of International Organizations

It should be the responsibility of international governmental and non-governmental organizations to initiate, develop and co-ordinate the educational efforts of different countries and to serve as an intermediary with the duty of safe-guarding the disinterestedness of all aid and assistance channeled through them.

One of the primary tasks of UNESCO should be to maintain a systematic survey of the known and anticipated educational needs of the developing countries, and of existing and potential educational resources of the more highly developed countries.

The "International University" scheme of UNESCO is to be commended and encouraged. Much greater participation in this scheme by the highly developed countries could yield a rich reward to the developed as well as the developing countries.

4. INTERNATIONAL CO-OPERATION

4.1 The Need for Analyses

All problems involved in the progress of education, science and technology must be solved taking into account the background provided by a given country together with its particular needs and resources. Nevertheless, the experience of other countries which have recently met similar problems, can be of great value.

International co-operation is essential for all stages of development but different forms of co-operation are appropriate for different situations. In particular, the stage of identifying and analysing the major problems in a country or region is very suitable for international collaboration, and in it the United Nations agencies can play a central role. Such analyses will almost always involve specialists from many disciplines; engineers, agronomists, operational analysts, natural scientists, sociologists, economists, specialists in public administration, and humanists concerned with the traditions and values of the people, must all work together. Many developing countries cannot yet provide such a powerful technological and scientific group from among their own personnel.

For concreteness we may cite two examples of problems requiring such a multi-disciplinary analysis:-

In the Ganges-Brahmaputra basin of India and East Pakistan, some 140 million people, 5% of the world's population, are crowded together on two tenths of one percent of the earth's land area. More than 90% of the people live on the land. Yet crops are grown only during the summer monsoon, when rainfall is very heavy

and the great rivers pour down a flood of water. During the remainder of the year, the country is dry and the people unemployed. Poverty and malnutrition are the common lot. Recommendations have been made for an intensive irrigation system which would enable a second, and perhaps a third, crop to be grown during the dry season. Although at first sight this may seem attractive, it is by no means obvious that it is the correct solution to the problems. If farming continues to be the principal means of subsistence, continuing rapid population growth would mean severe overcrowding of the rural areas. A better way might be to use most of the available development capital to promote industrial development and to improve transportation. But the correct solution requires an intensive and sophisticated analysis by many kinds of specialists, working together to assess the manifold consequences likely to follow from actions based on any particular plan.

A second example comes from the Maghreb countries of North Africa - Morocco, Algeria and Tunisia. Here the greatest possible development of water supplies for agriculture may still be inadequate to allow these countries to be self-sustaining in food production. The available water might be better used for industrial development where it can give a much greater yield than if applied in agriculture. Again, only a multi-disciplinary analysis will allow the best solution to be found.

If such analyses are to be acceptable to the developing countries, their representatives must play a substantial part in their organizing and work. A good analysis is the least expensive step in the development process, yet it can multiply

many-fold the effectiveness of even very large expenditures. It is, therefore, one of the best ways of using the relatively small funds available for development through the United Nations.

Many of the United Nations agencies and institutions supported by them, already perform limited analyses of one or another aspect of the problems of developing countries; but so far as we are aware, no agency has yet undertaken the multidisciplinary and integrated analyses which many of these problems urgently require.

4.2 An Institute for Resources Analyses

We recommend the establishment within the United Nations family of a semi-autonomous commission or institute for resources analyses. Its members would be those nations which wish to co-operate in making or using multi-disciplinary analyses of development problems within particular countries or regions. The institute, or commission, would have a relatively small but highly paid and highly qualified staff, employed on a rotating basis, of specialists in all the necessary fields. The tasks of these specialists would be:

- (a) to identify problems for analysis under the sponsorship of the institute;
- (b) to find competent groups within universities or research organizations of the member states, to undertake the analyses;
- (c) to ensure the completeness of the analyses and to make recommendations for necessary action by the countries concerned;
- (d) to arrange for training of teams from the developing countries in

the methods of analysis and data-interpretation.

The programme of the institute or commission, would be worked out and approved by conferences of the member states, but the work would be paid for by the countries in which the analytical teams were situated and by other countries interested in the problem. Thus, the budget of the institute itself could be relatively small (about \$500,000 per annum). Most of the problems selected for analysis would be those requiring the elaboration of analytical methods, or others of such complexity and difficulty as to be beyond the scope of the regional economic commissions of the United Nations.

Such problems would inevitably involve a great many of the disciplines found in a modern university. Of all the U. N. Agencies, UNESCO most approaches a university in the breadth of its interests and the scope of its activities, and it has the closest relations with the universities. We, therefore, suggest that UNESCO should play an important part in establishing and sponsoring the institute; but other specialized agencies of the United Nations should also be intimately involved.

4.3 Strengthening UNESCO

To strengthen UNESCO for this and other tasks in the application of science and technology to the problems of development, we recommend that the National Commissions for UNESCO in each member country should contain many more natural and social scientists and engineers than at present. We also suggest that national liaison agencies with UNESCO should include those concerned with science and technology as well as those responsible for education.

4.4 A World Health Research Centre

One of the results of an analytical

approach to national or regional problems will be the recognition of the needs for more accurate and more significant data, better and more complete surveys and research into unknown or imperfectly understood relationships. The United Nations Special Fund and the Specialized Agencies have already given valuable service in helping the developing countries to establish research centres, systematic survey methods and data collecting machinery, but much remains to be done. The programme envisaged for the World Health Research Centre, the establishment of which is now under consideration by the W. H. O., strongly emphasizes the need for research on the problems of collection, communication and interpretation of data on the social and economic aspects of public health, the influence of environment and nutrition on disease, and the effects on man of the man-made changes in the environment. We believe such a Centre could play a valuable role in facilitating international co-operation.

Preventable diseases and malnutrition take large tolls in human misery and economic loss. Profound changes have already been brought about by the application of scientific knowledge on communicable diseases and malnutrition, but nevertheless large gaps still exist in our knowledge of conditions affecting human health and well-being. In many countries, especially those newly developing, extensive demographic and epidemiological studies must be carried out before the relative importance of specific diseases and of other aspects of public health can be adequately assessed.

The most urgent needs for planning health are: first, action to provide more accurate data on the scope and the actual extent of disease all over the world, its consequences, and the social, environ-

mental and other factors involved; and secondly, the application of such new information in formulating overall plans for economic development to ensure a balanced and systematic effort. Unfortunately, the scientific methodology and tools are lacking for many important aspects of demographic and epidemiological studies. In addition, there is an absence of the necessary resources for research, particularly in countries where the problems are most serious. A major aim of the World Health Research Centre, is to remedy these deficiencies. The Centre would undertake research on major health problems of world-wide concern which cannot be effectively studied by local or national efforts. In its field operations, it would support and collaborate with existing research laboratories, and would seek to establish regional laboratories for specific needs, such as the study of certain tropical communicable diseases.

Studies on an international scale should be undertaken on the problem of population growth and its impact on economic development. This problem has to be attacked not only through biological and social studies but also through education. Any measures taken should be based upon the fullest respect for human dignity and freedom of choice. We recommend that the World Health Research Centre should initiate and encourage research on the biology of reproduction concerning which there is much ignorance.

4.5 Transfer of Technological Information

The developing countries have experienced great difficulties in obtaining trustworthy and sufficiently complete technical information on industrial processes and the design of machinery and plants for industry. Such information has been frequently hard to obtain from industrial con-

cerns in advanced countries. We can suggest no easy solution to this problem, but we believe that the recent action of the U. N. in establishing an Industrial Development Centre is a step in the right direction; but we urge that the U. N. and the Specialized Agencies do much more towards developing industrial consulting services, reference-collections of technological information, and a central exchange to publicize the needs in the developing countries for specific technical and industrial knowledge. In some developing countries, national consulting services for industrial technology have been established and they should be further developed and increased in number. They should be able to draw both on the U. N. services, and on assistance from individual advanced countries.

4.6 Co-operation between East and West

Co-operation in research on scientific and technical problems of development presents an outstanding opportunity for direct collaboration between scientists and engineers of the eastern and western countries. Research is required, for example, on soil - salinity control

in the Indus plains of India and Pakistan. A great deal of knowledge concerning similar problems has been obtained by agricultural scientists in the semi-arid regions of the U. S. S. R. and the U. S. A. Some of these scientists from both countries could gain valuable experience and mutual confidence by working together to apply their knowledge to this critical problem. Many other examples could be cited of opportunities for co-operation in research which would be mutually beneficial.

4.7 The Role of Scientific Unions

One of the important means of fostering co-operation between individual scientists in the advanced and the developing countries is through the International Scientific Unions and their co-ordinating body the International Council of Scientific Unions (ICSU). We welcome the initiatives recently taken by ICSU to increase its activities in the developing countries, and by UNESCO to place greater reliance on advice from the scientific Unions in planning and guiding its activities. National and international support of ICSU and the Unions must be strengthened if these initial steps are to lead to effective results.

Appendix

SUMMARY OF SUGGESTIONS AND RECOMMENDATIONS

1. Irrespective of disarmament each developed country should consider contributing 1% of its gross national product towards the development of poor countries - 5% of which should go to the advancement of science and technology;
2. The scientific societies in the developed countries should set up committees to advise and assist international agencies concerned with aid and development. All countries should seek to encourage a feeling of responsibility amongst their scientists towards the advancement of science in the developing countries.
3. The resources of the U. N. and its Specialized Agencies should be increased by providing them with direct sources of revenue outside the jurisdiction of natural states such as could be derived from taxation on space-traffic and communication, the resources of the oceans outside the limits of natural jurisdiction, including minerals from the ocean bottom, and from Antarctica.
4. Aid should be removed from the context of the cold-war, firstly, by international agreements which would ensure that an increasing proportion of aid for develop-

- ment would be given through the multi-lateral agencies of the U. N. ; and secondly, by common international enterprises for the developing countries, involving scientists and technicians from East and West, North and South;
5. Education is of supreme importance for developing countries, and should be given very high priority. The scientific attitude should pervade the whole of the educational process in the schools and the importance of applied as well as pure science should be stressed;
 6. The teaching of science in developing countries could gain much benefit from a study of the new methods now being applied in the advanced countries;
 7. For the developing countries, their own research is an indispensable instrument for their advancement and no investment of resources is so profitable. It should be generously supported on an increasing scale, the limitation being only the availability of competent people to do the work;
 8. In the early stages, particular attention should be given to researches important for a country's economic development, especially those related to its natural resources and their effective exploitation. Basic research not directed to immediate practical ends should also be supported;
 9. The programme for research in a developing country should be under the control of a Research Council or Academy provided with financial resources and largely guided by scientists, engineers and technologists;
 10. Much of the research in a country should be conducted within its universities. If specialized institutes are established, they should be located near a university and with close and friendly connections with it; and with a mutual interchange of staff and students for teaching and research;
 11. A variety of forms of exchange between staff and research students in universities and other institutions of higher learning in the developed and developing countries should be adopted to their mutual advantage;
 12. The loss of scientists from the developing nations by emigration to the advanced countries should be stopped by reducing the gap in the conditions of work between scientists in rich and poor countries, and by guaranteeing suitable positions to scientists being trained abroad on their return;
 13. International co-operation for aid to developing countries could be particularly appropriate and effective in distinguishing and analysing the major problems involved in the development of a country or region. It is suggested that an Institute for Resources Analysis should be set up within the U. N. family as a semi-autonomous commission or institute. It would be responsible for identifying the major problems, for organizing competent groups from universities all over the world to analyse them, and for making recommendations for action;
 14. The national commissions for UNESCO should be strengthened by the inclusion of more natural scientists and engineers than they commonly contain at present;
 15. The World Health Research Centre, whose establishment is now under consideration by W. H. O. , should consider undertaking among its other responsibilities research on major health problems of world-wide significance, including the development of methods to obtain reliable information on the extent of disease all over the world, its consequences, and the social and environmental factors involved;
 16. The U. N. and its agencies should develop consulting services, reference-collections of technological information, and a central exchange to publicize the needs of developing countries for specific items of knowledge.

P U G W A S H E V E N T S

THE CONTINUING COMMITTEE

Meetings of the Continuing Committee were held from the 23rd to 25th January in New Delhi, and on the 26th January and 2nd February in Udaipur. Much of the work of the Committee was concerned with immediate organizational matters of the Udaipur Conference. There was also much discussion on the organization of the 13th Pugwash Conference which is to be held in September in Czechoslovakia (see below). Apart from changing the dates, to avoid a clash with the United Nations Conference on the Peaceful Uses of Atomic

Energy, the Committee decided to modify several items of procedure, to ensure better preparation and more effective utilization of the Conference time. In particular, it will include the appointment of conveners of the Working Groups well ahead of the Conference, the division of the Conference into a "preparatory" and a "main" part, expectation of more "homework" by participants, especially those attending the preparatory part, and early circulation of Conference papers.

13th PUGWASH CONFERENCE

PRAGUE, 9th-12th September, 1964

KARLOVY VARY, 13th-19th September, 1964

The title of the Conference will be "Disarmament and Peaceful Collaboration among Nations" and it will consist of:-

- a. a Preparatory Conference, attended by 40 persons, to be held in Prague from 9th to 12th September;
- b. the Main Conference, attended by about 90 persons, to be held in Karlovy Vary (formerly known as Carlsbad) from 13th to 19th September. All dates are inclusive.

There will be 5 Working Groups with the following topics:

1. Measures for reducing tensions and the dangers of war, especially in Central Europe
 - i. Measures to prevent surprise attack
 - ii. Demilitarized and denuclearized zones and the elimination of foreign bases
 - iii. Non-aggression pact between NATO and Warsaw Pact countries
2. Current status of proposals for arms limitations

- i. Extension of the test ban to include underground tests and the adherence of all states
 - ii. Agreements to prevent the spread of nuclear weapons and weapons technology
3. Progress towards comprehensive disarmament
 - i. Cut off of production of nuclear missiles and weapons material, and negotiation of a minimum deterrent or nuclear umbrella agreement
 - ii. Possible effects of new technological developments on the elimination of the arms race and the achievement of general and complete disarmament
 - iii. New ideas
4. Problems of collective security
 - i. Collective security - immediate problems
 - ii. Methods for the peaceful settlement of disputes
 - iii. Security in a disarmed world
5. Aims and methods for peaceful collaboration among nations

- i. Role of science and scientists in advancing the cause of peace
- ii. Long-term consequences of disarmament on the development of science and technology

The geographical distribution of participants is envisaged as follows (the numbers in brackets denote the number of participants in the Preparatory Conference); Australia - 1; Belgium - 1; Bulgaria - 2; Canada - 1; China - 4(2); Czechoslovakia - 7(3); Denmark - 2(1); East Germany - 3(1); France - 4(2); Greece - 1; Hungary - 3(1); India - 2(1); Italy - 3(1); Nether-

lands - 3(1); Norway - 2(1); Pakistan - 2(1); Poland - 3(2); Rumania - 2(1); Sweden - 3(1); U.K. - 7(5); U.S.A. - 14(7); U.S.S.R. - 14(7); West Germany - 3(1); Yugoslavia - 3(1).

The Conference is being organized by the Czechoslovak Pugwash Committee under the auspices of the Czechoslovak Academy of Sciences. A Conference Organizing Committee has been set up consisting of Acad. F. Sorm (Chairman), Academicians J. Kozesnik, V. Knapp, I. Malek and K. Siska, and Mr. T. Nemeč (Secretary)

FUTURE CONFERENCES

The Fourteenth Pugwash Conference will probably be held in April 1965 in Italy; the exact date and location will be an-

nounced later. The Conference following that will probably be held in Poland.

DEATH OF PROFESSOR MORTON GRODZINS

We announce with regret the death on 7th March 1964 of Professor Morton Grodzins. He was Professor of Political Science at the University of Chicago and one of the first social scientists to take an active part in the Pugwash Movement. He participated in the 2nd, 3rd, 4th and 5th Conferences; ill health prevented

him from coming to later Conferences. His incisive comments and commonsense interventions did much to emphasize the useful role which social scientists can play in our Conferences. Grodzins has also worked hard on the organizational side and was instrumental in securing financial help for the U.S. Pugwash Group.

INTERNATIONAL COLLABORATION IN HEALTH SCIENCES

Proposal for a World Health Research Centre

The 7th Pugwash Conference in Stowe, Vermont, September 1961, was devoted to possibilities of large-scale international collaboration in science as a means of reducing political tensions. Health sciences were considered particularly suitable fields of activity for this purpose. The Conference's report aroused interest in several countries and in this way helped to initiate a detailed study that was started in late 1962 in the World Health Organization. This study,

in which many Pugwash scientists served as advisers, reviewed health problems of major importance to the world as a whole that were not being, and were not likely to be attacked adequately by purely national efforts, and recommended approaches towards their solution. Such problems include environmental pollution of air, water and foodstuffs, possible ill-effects of new medicaments and biological products given to large population groups, cancer, cardiovascular disease and mental illness.

The WHO study was completed in December last, and a final report was submitted to the WHO Executive Board in January 1964, and to the meeting in March of the World Health Assembly, the governing body of some 125 member countries.

The report proposes the establishment of a World Health Research Centre comprising three large functional divisions - epidemiology, communications science and technology, and biomedical research. At peak activity (in five to seven years) the total scientific staff would be between 1,200 and 1,300, with an annual budget of about 30 million dollars. Presumably, those governments which can best afford to pay would be expected to underwrite the costs involved for the first ten years at least.

It may be recalled that during the Dubrovnik meeting in September 1963 a report was received of the late President Kennedy's speech to the United Nations in which he mentioned steps, apart from the proposed joint U. S. A. -U. S. S. R. venture of the man to the moon, which could be taken on international collaboration in science and specifically in medical research, including a world communications centre under WHO, and regional laboratories for medical research. This reference was specifically to one aspect of the proposal for the World Health Research Centre. An outline of the proposal was distributed at the recent Pugwash meeting in Udaipur, and the Centre was mentioned in the final report as contributing usefully to problems of developing countries.

At the 17th World Health Assembly, which has just ended, a number of countries came out in support of major parts of the proposal, including Norway, Sweden, France, Czechoslovakia, Poland, Yugoslavia and Pakistan. Many others, including the U. S. A., welcomed certain aspects of the proposal but suggested concentration of activity on one or two features to begin with, such as epidemiological studies and communications. There was

practically unanimous agreement on the advisability of going ahead with activities connected with improving the worldwide exchange of information on health problems and biomedical research. Many reservations were expressed (by the U. K. and some Commonwealth countries, and the U. S. S. R.), notably with respect to embarking on laboratory research on selected biomedical problems (chemical and biological mutagens and toxic agents, cancer) and in molecular biology. The Assembly requested continued studies and more details on the subject of the establishment of a World Health Research Centre before making definite decisions on parts or all of the proposal, probably in 1965.

The establishment of a large centralized research undertaking, operated under the aegis of a U. N. Agency, is a new and historic departure in international affairs. This pattern of activity will no doubt develop in the future if the United Nations are to play an increasingly responsible role in world affairs. Any proposed resolution of such controversial questions as "big science" versus "little science", and "international" versus "national" research efforts cannot be expected to find universal acceptance. The general scientific soundness of the World Health Research Centre proposal, however, along with its potential effectiveness in helping to reduce international tensions, should be warmly welcomed and supported by all Pugwash scientists. A relatively small expenditure of funds could bring immense benefits to all humanity.

The year 1964 has been characterized by both Premier Khrushchev and President Johnson as one for peace probes and East-West collaboration. The WHO project would provide an auspicious start for joint scientific effort, and may help by example to bring to fruition other worthwhile suggestions made at Stowe.

THE CONTINUING COMMITTEE
OF THE PUGWASH CONFERENCES ON SCIENCE
AND WORLD AFFAIRS

Chairman: Lord Russell

Secretary-General: Prof. J. Rotblat

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