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ANNUAL PROGRESS REPORT OF THE SCIENTIFIC COMMITTEE
ON THE EFFECTS OF ATOMIC RADIATION FOR 1960

1. The Scientific Committee on the Effects of Atomic Radiation was established by resolution 913 (X) of 3 December 1955 at the tenth session of the General Assembly; its work was continued by resolutions 1147 (XII) of 14 November 1957, 1347 (XIII) of 13 December 1958 and 1376 (XIV) of 17 November 1959 at the twelfth, thirteenth and fourteenth sessions, respectively. It has the following members: Argentina, Australia, Belgium, Brazil, Canada, Czechoslovakia, France, India, Japan, Mexico, Sweden, Union of Soviet Socialist Republics, United Arab Republic, United Kingdom of Great Britain and Northern Ireland, United States of America.

Seventh session

2. The Committee held its seventh session at Headquarters from 11 January to 22 January 1960. Professor Rolf Sievert of Sweden served as Chairman, and Dr. E.E. Pochin of the United Kingdom was elected to serve as Vice-Chairman ad interim in the absence of Dr. V.R. Khanolkar of India.

3. At this session, the Committee considered the following topics: General Assembly resolution 1376 (XIV); certain technical questions, including the meteorological and physical aspects of fall-out, food chain problems, low-dose dose-effect relations; plans of discussion of genetic and C¹⁴ (carbon-14) problems at the eighth session. It also reviewed the plans for the joint United Nations/World Health Organization Seminar on Use of Vital and Health Statistics for Genetic and Radiation Studies held in Geneva, from 5 to 9 September 1960, and the time and place of the eighth session.

4. In response to a suggestion made by the Committee at its sixth session (A/4119, annex I, para. 2), the World Meteorological Organization arranged for a group of experts from eight countries to attend the seventh session of the Committee and to participate in its discussions of problems relating to fall-out mechanism. In the course of these discussions, the group delivered a set of some twenty valuable presentations covering topics in meteorology and fall-out. A resolution expressing the Committee's deep appreciation to the World Meteorological Organization (WMO) and to the individual experts for the assistance they had given the Committee during the session was adopted unanimously.
5. In response to a further suggestion of the Committee (A/4119, annex I, para. 3), its discussion of food-chain problems at the seventh session was materially assisted by a report prepared by an expert group of the Food and Agriculture Organization of the United Nations (FAO) and by the presence and contribution to the discussion of the rapporteur of that group as part of the FAO representation. A resolution expressing the Committee's gratitude to FAO for the report of its Expert Group on Radioactive Materials in Food and Agriculture and for its assistance to the Committee during the session was adopted unanimously.
6. In response to sections II, III and V of General Assembly resolution 1376 (XIV), the Committee gave preliminary consideration and study, in consultation with appropriate specialized agencies and the International Atomic Energy Agency, to appropriate arrangements for stimulating the flow of information and data and encouraging genetic, biological and other studies. The Committee decided to set up two sub-groups respectively to develop further the relevant physical and biological topics, and to prepare material for its further consideration at the eighth session. These sub-groups met during the seventh session of the Committee; one of them later met at the European Headquarters of the United Nations in Geneva, from 14 to 17 September 1960; both sub-groups met in Geneva during the period of the eighth session of the Committee.
7. In consequence of its consideration of sections II and III of General Assembly resolution 1376 (XIV), the Committee requested its Secretary to address a letter to States Members of the United Nations and members of the specialized agencies, expressing the wishes of the Committee to continue the flow of information relevant to its work and drawing the attention of Member States to certain specific problems.

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In response to this request, the Secretary of the Committee addressed a letter, dated 7 April 1960, to States Members of the United Nations and members of the specialized agencies, expressing the wishes of the Committee and suggesting means whereby this might be accomplished. Listed in annex I of the letter were the countries and organizations offering assistance in the field of sampling and analysis of radioactive material. This annex was later revised to include additional offers received up to 31 August 1960. Attached as annex II to the letter was a statement prepared by the Committee at its seventh session, suggesting ways and means whereby its requests for relevant information could best be channelled, in the respective countries, to the appropriate national scientific organizations and committees, as well as to individual scientists.

8. At this session, Dr. Manuel Martínez-Paez of Mexico was elected Chairman, and Dr. F. Hercik of Czechoslovakia Vice-Chairman, for the eighth and ninth sessions.

United Nations/World Health Organization Seminar

9. In response to a suggestion by the Committee (A/4119, annex I, para. 5), the United Nations and the World Health Organization (WHO) co-sponsored a Seminar on Use of Vital and Health Statistics for Genetic and Radiation Studies, which was held from 5 to 9 September 1960 in Geneva. At this Seminar, twenty-one papers were presented and discussed, and much useful information was exchanged between geneticists, epidemiologists, vital and health statisticians and civil registrars, on the future potentialities of vital and health statistics and civil registration procedures as a source of data in genetic and other studies, particularly in relation to the assessment of the effects of radiation in human populations, and on possible practical means for overcoming present limitations. The topics covered by the Seminar included: statement of the problem; present sources of information; current potentialities; radiation exposure and somatic effects; morbidity surveys; genetic surveys in selected populations; uses of routinely collected information for genetic use; information storage, retrieval and processing; biometrical genetics. The proceedings of the Seminar will be published.

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Eighth session

10. The Committee held its eighth session at the European Headquarters of the United Nations in Geneva from 19 to 30 September 1960. Dr. Manuel Martínez-Baez of Mexico served as Chairman, and Dr. F. Hercik of Czechoslovakia served as Vice-Chairman.
11. At this session, the Committee discussed genetic problems, C^{14} , fall-cut and associated subjects, and dose calculations; laid plans for its 1962 comprehensive report to the General Assembly; further considered and studied, on the basis of reports by its sub-groups, certain arrangements as requested by the General Assembly in sections II, III and V of resolution 1376 (XIV), and prepared its annual progress report for 1960.
12. A report on the Committee's consideration and study of appropriate arrangements for stimulating the flow of information and data, and for encouraging genetic, biological and other studies, including those concerned with C^{14} , that will elucidate the effects of radiation exposure on the health of human populations, called for in section V of General Assembly resolution 1376 (XIV), was adopted unanimously by the Committee and is appended to the present report as annex I.
13. The Committee noted with satisfaction the work done by the participants in the Seminar on Use of Vital and Health Statistics for Genetic and Radiation Studies. It strongly supported their Consensus of Opinion which it appends as annex II. The Committee was pleased to note that, in several countries, co-operation already exists between the official authorities concerned with registration of vital events and with the collection of vital and health statistics on one side, and the students of human genetics and radiation epidemiology on the other. It expressed the hope that this co-operation will give a lead to similar co-operation in an increasing number of countries. It also endorsed the value, in certain cases, of regional co-operative arrangements whereby more significant information might be achieved, and expressed the opinion that both the Statistical Office of the United Nations and the epidemiological branch of WHO should play the fullest possible part in assisting nations to undertake such programmes of survey and information retrieval, and in standardizing, co-ordinating and collating results. The Committee expressed its thanks to WHO for its co-sponsorship and to those Member States and their instrumentalities whose support and co-operation made the Seminar possible.

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14. The Committee decided to request that it might hold its ninth session at the European Office of the United Nations from 13 to 24 March 1961, and its tenth session at United Nations Headquarters, New York, from 4 September to 15 September 1961, or, if the needs of its work should so require, from 28 August to 15 September 1961.

Contractual study

15. Following the approval of the Committee's proposed programme by the General Assembly in resolution 1376 (XIV), and the associated financial provision, a Special Service Agreement was drawn up between the United Nations and the International Commissions on Radiological Protection and on Radiological Units and Measurements. Under this Agreement, the Commissions were to study the methods of evaluation of the exposures of man to ionizing radiation resulting from medical procedures, with special reference to radiation-induced diseases. Accordingly, an ad hoc Joint Study Group of these commissions met at United Nations Headquarters, New York, from 25 to 29 January 1960, and in Stockholm, from 1 to 9 July 1960. A report on the deliberations and conclusions of the International Commissions is to be submitted to the Scientific Committee by the end of 1960.

Flow of information

16. The Committee has a continuing interest in the somatic effects of radiation, and expressed its appreciation to the International Atomic Energy Agency (IAEA) for its part in the organization of the recent Conference on the Relation of Radiation Damage to Radiation Dose in Bone.

17. The Committee has received and hopes to continue to receive information on radioactive contamination, radiation levels and radiobiological questions from States Members of the United Nations and members of the specialized agencies, and from the specialized agencies, IAEA and the International Commissions on Radiological Protection and on Radiological Units and Measurements. During the period from 15 June 1959 to 1 September 1960, the Committee received some 200 reports from States Members of the United Nations or members of the specialized agencies, and from specialized agencies and the IAEA.

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Further reports

18. The Committee intends to submit annual progress reports to the General Assembly, to report to the Assembly on each phase of its scientific work separately, as it is completed, and to submit a further comprehensive report during or before 1962.

Staff and consultant services

19. The Committee compared the greatly increased volume, scope and specialization of the information it is receiving in preparation for its next comprehensive report with that available to it in 1958 for the previous one. It expressed the opinion that the preliminary stages of summarization and collation probably could not be handled by a scientific staff of the same size as previously. The Committee decided to draw the attention of the Secretary-General to this temporary situation and request him, as in the past, to make appropriate flexible and ad hoc arrangements by means of additional staff or consultants. In the Committee's view, these should not need to exceed a total of about one and a half man years of scientific effort in all.

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ANNEX I

REPORT TO THE GENERAL ASSEMBLY PREPARED IN
RESPONSE TO RESOLUTION 1376 (XIV)

1. Under General Assembly resolution 1376 (XIV), the United Nations Scientific Committee on the Effects of Atomic Radiation has been requested to consider and study appropriate arrangements for stimulating the flow of information and data relative to the effects of radiation on man and his environment, and to consider and study more effective arrangements for encouraging genetic, biological and other studies, including those concerned with C^{14} , that will elucidate the effects of radiation exposure on the health of human populations.
2. The major flow of material to the Committee thus far has come from a relatively few nations. It has been predominantly informative as to radiation and radioactive contamination levels, less with regard to epidemiological and other biological aspects. The Committee has reviewed these scientific data and literature and has made available its findings. However, the Committee has not received from all Member States the same amount of assistance implicit in the selection and submission of data that it judges relevant to its field of work. The Committee is anxious to receive a continuing and increasing flow of facts of physical and bio-medical import both from those Member States who are represented on the Committee and from those who are not, and it considers it to that effect desirable that, when appropriate, the Committee avail itself more actively of the experience of the latter in its scientific deliberations as a working group.
3. The Committee will continue to work closely with interested United Nations agencies and certain other groups, whose scientific meetings and studies have already been of great assistance to the Committee, and hopes that Member States will also co-operate with these organizations, in addition to continuing to send relevant data directly to the Committee.
4. During its seventh session the Committee decided that one of the most immediate problems was to obtain further data on environmental contamination from areas not covered by previous surveys. On 7 April 1960 a letter was

therefore addressed to all Member States, outlining the type of data required from certain areas of the globe. Reference was made in this and a subsequent letter to offers by Member States and IAEA to analyse samples for countries which lack the necessary facilities.

5. During its eighth session, the Committee reviewed the available data on radiation exposure. Their principal conclusions relevant to this aspect of the report are noted in paragraphs 6-10 below.

6. Natural activity: Measurements of natural radiation are of particular importance since not only is this at the present time the major radiation source to which the world population is exposed, but also, especially considering the known variations in the natural radiation levels, it is a valuable basis with which the magnitude of artificial radiation sources can be compared. The components of the natural radiation dose for which additional data are needed both on a regional and on a world-wide basis are those delivered by gamma radiation from the earth's surface and by alpha emitters in bone. The stimulation of research on these aspects is particularly important.

7. Environmental contamination from nuclear tests: Environmental contamination from nuclear tests, as in the past, has continued to occupy the centre of attention of the Committee, since radiation from this source involves the whole population of the world. The Committee has reviewed the data that are now available on fall-out from nuclear tests. Considerable additional information on the basic patterns of contamination from fall-out and C^{14} has been obtained recently. While the Committee is anxious to obtain more precise information on many aspects, it is none the less apparent that certain of the parameters, such as the rates and amounts of deposition, are known with an accuracy sufficient for the estimation of some components of the tissue doses from fall-out. The Committee has considered the accuracy with which the present average dose to bone and gonads can be assessed. This assessment depends primarily on direct measurement of strontium-90 in human bone and of caesium-137 in the body, but this must be supplemented, particularly for the purposes of future prediction, by measurements of levels in diet and the food chain. The Committee regrets the scantiness of data from several large and heavily populated areas. It recognizes

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that the obtaining of improved information has been largely limited by the inadequacy of information on the composition and origin of diets; this information is necessary both for designing adequate sampling programmes and for the interpretation of results. In this connexion, dietary information assembled by FAO has been of considerable assistance to the Committee.

8. Environmental contamination from radioactive wastes: Much valuable study has already been undertaken by governmental agencies and international organizations on various problems in the disposal of radioactive wastes. The exposure of the population of the world from this source over the next several decades is difficult to estimate because of the lack of information both as to disposal policy and the fraction of fission wastes which might be used in industrial processes. We can expect that technical progress should enable human exposure from this source to be more readily controlled. The Committee wishes to continue to receive information on all significant releases of radioactive waste into the environment. It notes that relevant information is also received from Member States by the IAEA and other United Nations agencies, and that these organizations constitute an appropriate channel for transmission of it to the Committee. The Committee attaches importance to detailed studies of the behaviour of artificial radioactive materials in the environment. Information obtained in this way is necessary for improving estimates of exposure of mankind from possible future releases of radioactivity.

9. Medical exposures: As in the past, the Committee will continue to give considerable attention to medical exposures for two reasons: firstly, the exposure is considerable in some countries and, secondly, persons exposed for medical reasons may provide a group of particular interest for subsequent study of dose-effect relationships. For the latter purpose, the importance of adequate control and recording is apparent and there is room for improvement in this respect in many countries. In this connexion, and at the request of the Committee, the International Commission on Radiological Protection and the International Commission on Radiological Units and Measurements are conducting such studies on medical exposures.

10. Occupational exposure: The radiation dose resulting from occupational exposure is sufficiently well documented for the assessment of population dose

from this source. It contributes at present only a small fraction of the total dose to the population in technologically advanced countries.

11. During the past sixty years, and especially during the last few of them, much has been learned of the biological effects of radiation by experiments on living organisms and their parts and by observations on human beings exposed by accident or treated by design. This active and diverse research has divulged valuable basic understanding of how ionizing radiation exerts its effects and much information of semi-quantitative predictive value, especially relating to gross effects resulting from high doses. But the considerations and predictions needful to sound and confident action of all kinds in the nuclear era have progressively embraced lower doses and dose rates, and effects progressively more and more delayed - including those upon subsequent generations - and more and more refined in nature: at the same time, both the numbers of people potentially affected, and the administrative and legal needs of precision have increased. Physical data has improved rapidly allowing a continually greater accuracy in the estimate of tissue dose. Because of the inherent variability of biologic material, comparable precision of information probably cannot be obtained in the biological sphere, but a closer appreciation of dose-effect relationships can and should be evolved.

12. Ideally, there is no substitute in prediction for sound quantitative observations relevant to man as he lives, complemented though this must be by understanding based upon a wide variety of observations in cellular, mammalian and other areas of radiobiology. Much information can come only from the slow and painstaking collection of information about irradiated and other groups of persons. In considering radiation research at its present phase, the Committee has therefore accorded such activity a very high priority.

13. Essential to evaluation of any study of radiation effect on population is the collection of relevant biological information concerning that population. Such information ranges from relatively simple indices of the genetic health or structure of the population at large to the rates of incidence, in comparable exposed and unexposed groups, of diseases such as leukemia, skin cancer, or cataract which can possibly be radiation-induced. Governments and their statistical and epidemiological agencies are peculiarly well-placed to advance such work, which could perhaps, in some areas, profitably be the subject of regional co-operation and standardization.

The Committee hopes that the proceedings of the joint UN/WHO Seminar on Use of Vital and Health Statistics for Genetic and Radiation Studies will assist such developments. It particularly draws the attention of the General Assembly to the joint and considered opinion of the experts who attended the Seminar, as reviewed by the Committee and appended to its report as annex II. It notes that countries having large populations living in areas of high natural radiation may have special opportunities for profitable studies.^{a/} The Committee notes with satisfaction that WHO is willing and able to be of much assistance in connexion with surveys of comparable exposed and unexposed groups and is, indeed, actively engaged in studying the feasibility of projects of this kind, such as the possibilities which might exist among groups exposed to radiation occupationally or for medical purposes.

14. The Committee notes that information collected by various national authorities becomes more valuable when it is collated with corresponding material from other countries. It therefore hopes that all national authorities engaged in such studies will make available their results and will gather them according to standards of procedure and practice which make them comparable with those of other countries.

15. In respect of both hereditary and other diseases, there is much to be done, even in the technologically most advanced countries, by way of standardizing nomenclature and of improving diagnosis and recording and handling of information. A concrete suggestion which has been made concerns appropriate expansion and modification of the International Classification of Causes of Death in so far as these relate to genetic or radiation-inducible conditions. It is relatively simple to obtain certain measures of the genetic health of a population, of its genetic structure and progression, and even to obtain some information about mutation, from vital and health statistics, but only if these are of an adequate standard of accuracy and appropriately collected and arranged.

16. Many of the biological experiments essential to permit more accurate evaluation of physical data in terms of effects on man, particularly those urgently needed in the low dose and genetic fields, are costly in trained workers and materials. The Committee therefore urges that when extensive and long-range

^{a/} In this connexion, the Committee draws attention to the views of the WHO Expert Committee on the Effect of Radiation on Human Heredity: Investigations of high natural radiation (WHO Technical Report Series No. 166).

biological research programmes are to be undertaken the Committee be informed, so that it can know where it may look for results in given fields and also can help to avoid unnecessary expenditure of effort. As far as the information on human populations is concerned, the Committee wishes to emphasize the value of such exchanges of views as are mentioned in paragraph 6 of annex II.

17. Many other problems require to be worked out, including biological measures of dose, techniques for reducing the severity of the effects of radiation exposures, the possible localized effects of transmutations, such as those of Cl^{14} , and in general a fuller understanding of mechanism of radiation effects at all levels - all endeavours in which new advanced techniques and knowledge are rapidly being applied and which require survey and experimentation of a great diversity of scale and kind. The Committee hopes that Member States will continue this research and will make the results available for the benefit of all.

18. The Committee notes that many Members of the United Nations have considerable anxiety concerning ionizing radiation. It draws attention to the fact that among the proper corollaries of such anxiety is the participation in the gathering and dissemination of the required data, so that the accuracy of the assessment of radiation from all sources can be improved.

19. The Committee reiterates the view that progress in the solution of biological problems of the effects of ionizing radiation can be made, but both sustained effort and time - measured in several decades - will be needed. It is aware that, in this nuclear age, much depends upon mutual confidence and upon a communal advance of knowledge in which each member of the international community carries to the full its share of effort, aided by the appropriate inter-governmental agencies.

20. The Committee is conscious of its position in the United Nations family as the central forum for discussion of these questions with the active co-operation of the United Nations agencies. It has repeatedly found that when a scientific problem is attacked by an appropriate group of experts, co-operation, progress and good working relations come to exist with a minimum of formal co-ordination.

ANNEX II

CONSENSUS OF OPINION OF THE EXPERTS PARTICIPATING IN THE
UN/WHO SEMINAR ON USE OF VITAL AND HEALTH STATISTICS FOR
GENETIC AND RADIATION STUDIES

1. The participants in the Seminar on Use of Vital and Health Statistics for Genetic and Radiation Studies have conducted a general and detailed examination of the current adequacy and future potentialities of civil registration procedures, as well as of vital and health statistics as a source of data in studies of genetics and of the effects of radiation in human populations. They have considered practical suggestions for overcoming present limitations, so as to meet, in particular, the critical needs of human geneticists and radiation epidemiologists.
2. The participants note with satisfaction that co-operation between the official authorities concerned with registration of vital events and with the collection of vital and health statistics, on one side, and the students of human genetics and radiation epidemiology, on the other, has already been initiated in several countries and that closer contacts between them are to be expected in the future.
3. In the conviction that we are entering an era in which knowledge of the genetic endowments of human individuals and populations will lead to new insights into the health and well-being of mankind, it is suggested that contacts between biological scientists and vital and health statisticians be maintained and expanded and that full advantage be taken of this co-operation through frequent and continuing consultations between authorities concerned with the statistics of civil registrations and biologists on matters of common interest.
4. The participants are aware of the fact that a large part of the duties of civil registration authorities is of a legal and administrative nature and that the procedures for the collection of vital statistical information were not, and cannot be, merely designed to meet the needs of human biologists, but they are also acutely aware of the fact that any progress in human biological sciences can have wide repercussions in other disciplines, like demography, whose import for the social and economic welfare of the population is well known.

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5. Progress towards meeting the needs of human biologists may take the form of altering existing procedures which should, of course, be assessed in a context of local situations. They can, however, often be achieved through rather simple means, without drastically changing established systems. A variety of measures will be found useful to that effect and some of them can be outlined in very broad terms:

- (a) Supplementing the information available on routine records by linkage with other records relating to the same individual;
- (b) Reconstruction of segments of biological families through record linkage so as to permit longitudinal studies over a number of generations;
- (c) Recording of such items of information as are required to identify consanguineous marriages, in order to make possible the assessment of their effects on the survival, health and growth of offspring;
- (d) Setting up partial or complete registers of population groups of genetic and medical interest such as twins, people suffering from hereditary diseases, congenital malformations, malignancies;
- (e) Introduction into vital and health statistics programmes of additional items of information required for analysis or linkage, as well as special tabulations as may be needed;
- (f) Better and more extensive exploitation of data useful to assess fertility patterns and differentials;
- (g) Facilitating the estimation of doses delivered to patients during medical X-ray work, for example by keeping in X-ray departments appropriate records of normal practices, types of equipment, etc;
- (h) Improvement of basic quality of data by such means as are appropriate, including removal of ambiguities in terminology and in the structure of the questions, querying imprecise replies, making the certifying physicians and other informants more aware of their responsibilities;
- (i) Developing a list of pathological conditions of genetic significance which could usefully supplement the International Classification of Diseases;
- (j) Taking such initiative as may be necessary to ease the limitations to the accessibility of the records for research purposes.

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6. However simple, many of the developments which can be envisaged will require thoughtful consideration before being adopted. The import of some of the results which can be anticipated will be mainly limited to the country in which they will be obtained and therefore parallel studies are not to be discouraged. There may, however, also be investigations of a general validity and for some of these, in view of their cost, possible duplication should be avoided. It is therefore felt to be useful that the discussions initiated at the Seminar be continued not only within the various countries but also, on a restricted scale, at the international level under the aegis of the sponsoring organizations, so as to advise administrations and research workers of current developments in different countries, and so enable them to co-ordinate such activities, with a view to making the best possible use of available resources.

7. The present state of development of human biology requires flexibility of approach, and the contribution of vital and health statistics to genetic and radiation studies will have to be judged on results which may not emerge immediately. Some of the possible approaches will prove more fruitful than others, but increasing knowledge in these fields is bound to be of the greatest social benefit.

ANNEX III

FINANCIAL IMPLICATIONS

1. At the time of adoption of the decisions recorded in paragraph 14 of the present report, the Committee was informed that the holding of its ninth session at the European Office of the United Nations would require an additional expenditure approximating \$5,800, but that the precise figure would depend on the detailed pattern of conferences; while the extension of its tenth session by one week, should this become necessary, would cost \$2,625.

2. At the time of adoption of the decision recorded in paragraph 19 of the present report, the Committee was informed that consultant services amounting to one and a half man-years of scientific effort would require an additional expenditure of \$15,000.
