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REPORT ON RADIATION EFFECTS

The Committee on the Biological Effects of Radiation of the National Academy of Sciences released a supplementary report on May 5 (NAS Summary Report, 1960) which deals with those developments of interest since its original report (NAS Summary Report, 1956). Although "the steady accumulation of scientific information since 1956 has not brought to light any facts that call for a drastic revision of earlier recommendations," the present report does emphasize certain important recent observations on the relationship between dose rates and genetic effects and on the mounting problems relating to radioactive waste disposal that underline the need for continued conservation and complete candor in considering radiation and its effects."

The Committee is composed of six independent subcommittees and the reports of their major findings and conclusions are briefly summarized in the following excerpts.

Committee on Genetic Effects of Atomic Radiation

The assumed constancy of the total genetic effect irrespective of dose rate, has turned out not to apply to spermatogonia and oocytes which are the most important stages of the human male and female reproductive cells.

Among the reported new findings that have a bearing on the assessment of the genetic effects of radiation are the following:

1. In mice, fewer mutations are produced in spermatogonia and oocytes by chronic irradiation (i.e., a low dose rate) than by the same amount of acute irradiation (i.e., a high dose rate) when the total dose is the same. However, the data are not yet sufficient to establish the precise quantitative relations between dose and effect at low doses for either acute or for chronic irradiation.

2. There is some shortening of life in the progeny of irradiated male mice, as well as in the irradiated mice themselves.

3. Additional studies on children of survivors of the atomic bombings at Hiroshima and Nagasaki, suggest that the sex-ratio in these children has been slightly but significantly altered as a result of radiation-induced mutations affecting prenatal viability.

The fact that the earlier estimates of genetic damage from fallout were based on data from acute rather than chronic irradiation means that the effect of a given amount of fallout, or other radiation delivered at low rate, may be less than was previously estimated.

The Committee continues to recommend that for the general population, the average gonadal dose accumulated during the first thirty years of life should not exceed 10 r of man-made radiation, and should be kept as far below this as is practicable.

Committee on Pathologic Effects

Although the general features of radiation-induced pathology are quite similar in animals and in man, each species has some unique peculiarities of response. Thus, all experimental data, even if completely established in animals, are not directly transferable to man.

In animals for a constant dose rate, the amount of life shortening increases as the radiation dose is increased. For a constant total radiation dose, the amount of life shortening increases as the dose rate is increased.

A life shortening effect in man is to be expected after substantial doses of whole-body radiation. This expectation comes from the results of animal experiments and from the fact that such exposures increase the incidence of leukemia in human populations. There are no studies adequate to

(Continued on Page 4)

SENATOR HENNINGS ASKS FOR INFORMATION

The following request for information was received by FAS on May 5, 1960.

"In the course of a continuing broad study of freedom of information and secrecy in government, the Senate Subcommittee on Constitutional Rights has been seeking to learn what effect, if any, restrictions on the availability of information have had on scientific development and progress in the United States.

"Now the subcommittee is in the process of compiling descriptions of specific instances where scientific progress may in some way have been hampered by restricting or withholding of information from (a) individual scientists, (b) groups of scientists, (c) authors and publishers of popular-language science articles, and (d) members of the public.

"Any information or statement which you or the members of your association could furnish about such instances would be welcomed and should prove very valuable to the subcommittee in its work."

The letter was signed by Thomas C. Hennings, Jr., Chairman of the subcommittee. FAS members who can provide the Senator with specific information are urged to write to him at Room 104-B, Old Senate Office Building, Washington 25, D. C.

POST-SUMMIT REACTION

Members of the Democratic Study Group of the House of Representatives asked President Eisenhower to answer questions about the events preceding the ill-fated Summit Conference. The informal group includes Chester Bowles (Conn.), Chet Holifield (Cal.), Lee Metcalf (Mont.), James Roosevelt (Cal.), Frank Thompson, Jr. (N. J.), Henry Reuss (Wis.), and Samuel Friedel (Md.).

The letter sent to the President said:

"We are distressed over the collapse of the Summit meeting and the damage to our prestige and leadership in the world. The cause of world peace has been endangered. We believe that Congress and the people must ask the following questions. We believe it is the Administration's responsibility to answer these questions."

- "Why was the U-2 flight over the Soviet Union ordered just prior to the Summit meeting?"

- "When the U-2 incident became public, why were a series of contradictory and false statements issued by Administration officials—and who was responsible?"

- "Why did the Administration order a world-wide military alert from Paris on the eve of the Summit?"

- "Why did the Administration first indicate that as a matter of national policy it would continue manned flights over Russia, and then reverse itself and say that it had ordered them discontinued?"

- "Was it necessary to compromise the announced peaceful role of the National Aeronautics and Space Administration by using it as a cover for an espionage operation?"

- "Why was there no co-ordination between the agency responsible for the U-2 flight and the agency responsible for our diplomatic functions?"

- "Why did the President announce in advance that as our Chief of State he might return to Washington before the conference ended?"

- "Has the traditional American policy of civilian supremacy over the military been impaired?" (W. Post 5-21.)

DISARMAMENT CONFERENCE DEADLOCKED

The ten nation East-West disarmament conference recessed on April 29th until June 7th. After a month and one half of discussion, the conference was in complete deadlock on the principles, as well as the detailed plans, that should guide disarmament. The Russians want an agreement to abolish or reduce armaments within a given time period; the inspection machinery would apparently be of subsidiary importance to the agreement. The U. S., with no firm time period in view, wants a gradual, thorough, phased arms limitation program, with each step firmly accompanied by the establishment of control and inspection machinery.

U. N. Disarmament Debate Foreseen:

On April 27th, the Canadian delegate to the disarmament conference said (N. Y. Times 4/28) that the West was willing to have the U. N. give its political judgment on the opposing Communist and Western approaches to disarmament. Now that the hopes for some compromise agreement on disarmament principles at the Summit Conference have been shattered, it appears that the disarmament talks may become a major political item on the agenda of the U. N. General Assembly session in the fall. Until then, every indication is that the negotiations will resume in Geneva on June 7th, but the chances of progress seem slim (N. Y. Times 5/22).

Khrushchev's Views:

At a press conference following the abortive Summit meeting, Khrushchev was asked "if the Soviet Union will continue the talks on disarmament and on the suspension of nuclear tests?" In replying that the Soviet Union would continue to negotiate at Geneva, Khrushchev indicated that there is still a possibility to reach agreement on the discontinuance of atomic tests. He continued: "The disarmament negotiations are another matter altogether. We are almost convinced that our partners on these disarmament negotiations do not want disarmament but want simply control over armaments, which is in other words the collection of espionage information. We will not agree to this. We are for true disarmament, for true control measures, so that no one should threaten anyone else. What is going on now at Geneva is merely procrastination. But if this procrastination goes on we will be compelled to approach the United Nations and to say that our partners do not want to reach agreement and that we are asking the U. N. General Assembly to consider the matter." (N. Y. Times 5/19)

MISSILES AND DEFENSE

In the aftermath of the tragic end of the summit conference, a call for increased emphasis on defense is not unexpected. General Thomas D. White, Air Force Chief of Staff, immediately asked Congress for two additional Atlas squadrons (12 missiles each) within the next three years (W. Post 5-20). He also pleaded for restoration of the funds for the Bomarc anti-aircraft missile, which had been cut to the bone by the House, on recommendation of the Pentagon, after reportedly over \$3 billion had been spent on its development (W. Post 4-13). The Bomarc had a long record of failures (W. Post 4-16); its place in defense was to be taken by a piloted jet craft, the F-106 (W. Post 5-20). The House Committee had changed the President's defense budget in various other areas, such as increasing funds for Polaris submarines and the Midas (early warning), the Samos (reconnaissance), and the Discoverer (manned) satellites (W. Post 4-30).

An organizational change in the Defense Department centralized control of missile and space vehicle tests in the office of Herbert F. York, Director of Defense Research and Engineering. His deputy will be Maj. Gen. Donald N. Yates, former head of Cape Canaveral missile testing center. York will coordinate the work of the Navy's Point Arguello and the Air Force's Vandenberg missile facilities (W. Post 4-8). Other recent developments included the successful firing from underground of a Nike-Zeus missile, a 9000 mile flight of an Atlas missile (8000 miles further than its previous record) and the announcement of a high sensitivity radar photo system which together with the weather observer satellite could provide an improved reconnaissance system in the near future (W. Post 4-29, 5-21, 4-20).

NEW USES FOR SATELLITES

Two new satellites have been added in recent weeks to the already sizable number of man-made objects in space. Three of them are preliminary versions of rather elaborate satellites designed for very special functions.

The 4½-ton Russian space ship launched May 15 is significantly heavier than any previous satellite. The Soviet news agency Tass reported that it "has a pressurized cabin on board, which contains a dummy space man [and] all the necessary equipment for a future manned flight." (N. Y. Times 5-22-60.) The capsule was expected to burn up on reentering the atmosphere. But this fate was delayed when an attempt on May 19 to send the capsule back to earth failed after a malfunction. (N. Y. Times 5-21-60.)

Transit I-B

The American satellite Transit I-B, an experimental forerunner of a proposed four-satellite navigational system, was launched April 13. It is envisaged that information on such a satellite's orbit would be relayed to it for rebroadcast together with a steady note at an accurately controlled frequency. By combining measurements of the Doppler shift of this frequency with the orbital information received from the satellite, an observer on a ship or submarine would be able to fix his absolute position to within one-fourth of a mile.

TIROS and Pioneer V

The TIROS weather satellite and the Pioneer V space probe (NL 60-3) continue on their way. Pictures sent by TIROS allowed a hurricane 800 miles east of Brisbane, Australia to be spotted before its existence had been reported here. Later word from the Australian Weather Bureau confirmed the storm's existence (W. Post 4-11, 12-60). Although TIROS could well be the forerunner of military reconnaissance satellites, there was no formal protest on its passage over Russian territory.

On May 8 the 150-watt radio transmitter of the outer space probe Pioneer V was successfully turned on by signals from the 250-foot radio-telescope at Jodrell Bank, England. This more powerful transmitter replaced the 5-watt instrument which could no longer be heard. When the new transmitter was activated Pioneer V was 8 million miles from earth. It was hoped that contact would continue for another 36 million miles. There was some concern, however, that a leak in a battery might terminate the transmission sooner (W. Post 5-9-60).

MORE SPACE FUNDS AUTHORIZED

The Aeronautical and Space Sciences Committee of the Senate added 55 million dollars to the budget requested by the Administration. The committee voted unanimously to approve a bill authorizing \$970 million for the National Aeronautical and Space Agency for the coming fiscal year beginning July 1. An appropriation bill to vote the actual funds may come close to the \$915 million requested by the Administration. That is \$145 million over this year's NASA appropriation. (N. Y. Times 4-30-60.)

EDITORS NOTES

*Complaints about Pentagon secrecy and censorship have been raised by private groups dealing with the Army. The Army classified a report on machine tools prepared for it by the Operations Research Office of the Johns Hopkins Institute. Although the report had circulated for over a year, the Army clamped a confidential label on it after a newspaper report on the subject appeared. Other research agencies and scholars on Government contracts have also felt the security pinch lately (W. Post 4-18).

*In Moscow there is a seven story building that houses an organization known as "I.R." The initials stand for "Information Retrieval." The function of I.R. is to gather and collate every item of scientific or technological information published everywhere on the globe. I.R. has been going for 10 years, has access to 60,000 books, 1,200,000 technical papers, 55,000 magazines per annum and publishes, in Russian, a 4000 page reference bulletin monthly (W. Post 4-17).

*The Joint Committee on Atomic Energy has announced hearings on the Basis and Use of Radiation Protection Criteria and Standards to commence on May 24. FAS members W. Selove and R. Lapp will take an active part in the discussions.

BOOK REVIEW

"Fallout"

Ed. By John M. Fowler

Basic Books 1960. 235 pp. \$5.50.

FAS readers should have a soft spot in their hearts for this altogether admirable book, since it stems from and epitomizes our dominant concern for public understanding of the social implications of fission and fusion. Inevitably, the book does not begin or end with fallout, and indeed fallout figures as an almost incidental facet in the larger picture of what Adlai Stevenson calls in his foreword "our nuclear dilemma." What this uniformly excellent panel of experts has in fact produced is an up-to-date and integrated primer for life in the radiation age, which succeeds, by a combination of beautifully succinct and lucid writing, well-selected documentation, and rigorous reasoning, in achieving a presentation which is both comprehensible to the layman and full of interest even for the professional scientist.

The book deals with the problem at three levels, fact, mechanism, and implication. We are first told the names of the principal bomb products, their qualitative differences, quantitative significances and (in an appendix) mechanism of origin (John Fowler). The growth and ostensibly capricious distribution of fallout then take on new significance as related to recent evidence and theories of global tropospheric and stratospheric circulation (Lester Machta and Robert List). Next, the multiple paths of entry of these poisons into the body and the rationale of their localization are considered (W. O. Caster). The acute and chronic effects of these intruders on the individual ("marrow," "intestinal" and "central nervous system death," cancer, life-shortening) are discussed critically in relation to the threshold, mechanism of effect and "permissible limits" in a superb chapter by Walter Guild which contrives also to give a feeling for the logic, beauty, excitement and limitations of scientific experiment. Hereditary effects are next interpreted in relation to genetic theory in a chapter by James Crow which is a gem of judicious selection and exposition. This is followed by engrossing chapters on radiation accidents (Gould Andrews) and the present status of protection and treatment (Jack Schubert). Realistic analyses of civil defense (Chet Holifield) and detection of bomb tests (Arthur Rosenfeld) then lead to an artistically matter-of-fact description of nuclear war (Ralph Lapp). Fowler's closing chapter on national survival does as well as informed imagination can do to grapple with the literally inconceivably situation that would confront survivors if, to quote James Hilton, "... men, exultant in the technique of homicide, would rage so hotly over the world that every precious thing would be in danger, every book and picture and harmony, every treasure garnered through two milleniums, the small, the delicate, the defenceless . . ." and he is skeptical of the feasibility of tolerable life in bomb shelters or of recovery of anything resembling civilization.

The authors of this book have apparently taken to heart the lesson learned by many of us in the crusading postwar days, that the public cannot be terrified into thinking about the consequences of nuclear war—it then simply refuses to think at all. Thus, in accord with Fowler's avowed purpose "to inform, not to mold public opinion," and hope that "fear's closed eye and apathy's glazed eye . . . be cleared by knowledge" the contributors maintain a scrupulously objective tone, eschew most political and military judgements, emphasize the uncertainties of data and theory, admit the possibility of valid differences in interpretation, and put relative and absolute effects into proper perspective. Nonetheless it would be an impervious reader who did not sense the underlying urgency of these messages, and it is to be hoped that the book is not so dispassionately fascinating that the reader fails to realize that he is seeing forecasts of his own possible vaporization, "marrow death" or mishappen descendents. Perhaps no better epilogue could be found than the last two paragraphs of Guild's chapter:

"As I have pointed out, the uncertainties about these numbers are not important to the way I feel about fallout: the odds against damage are high enough so that I do not feel any special concern for the safety of my family or myself. Yet because the number of people seriously hurt is not zero, I feel I must ask whether the risks are justified. This takes us out of the area of science into morals and politics in the broadest sense. Speaking now as a layman, I personally have two thoughts on this matter. The first is that there are many areas of life in which we as a nation can and will affect more people's lives for better or worse,

CLEAR STAND ON GERM-GAS WAR ASKED

Congressman Robert K. Kastenmeier (D. Wis.) called on President Eisenhower to provide a clear statement of administration policy with respect to biological and chemical warfare (Press release, 4-5). Last September Mr. Kastenmeier introduced a resolution (H. Con. Res. 433) that would reaffirm American intentions not to use biological or chemical weapons unless they were first used by an enemy. The House Foreign Affairs Committee requested a State Department opinion. The request was acknowledged on September 15. Last month Mr. Kastenmeier rose to inform the House that no further communication had been received on what he called "this crucial moral and philosophical question, involving the world image of the United States." President Eisenhower, in his January 13 press conference, answered a direct question on the matter of chemical and biological warfare by stating that "my own instinct—is to not start such a thing as that first." Yet no formal opinion has been made available from the State Department and this is delaying House consideration of Kastenmeier's resolution, leading him to ask if "there are differences between the State Department and other departments on whether the United States should use gas and germ weapons before an enemy uses them?"

Concern about our posture before the world on the question of germ warfare was also expressed last month by a group of ten Congressmen. In a message sent by them to a symposium on chemical and biological weapons sponsored by the American Chemical Society, they stated that "so long as the United States has not taken a formal position reaffirming our national purpose never to use (chemical and biological) weapons unless used first by an enemy . . . the world will be uneasy about our intentions. . . ." They specifically suggested that defensive research be taken out of the Army Chemical Corps and given to another agency, perhaps the Public Health Service.

Soviet Preparations. At the same time it appears that the Russians are, if anything, further ahead of us in preparations for biological and chemical warfare than they are in the missile field. In testimony before the House Defense Appropriations Committee, Lt. Gen. Trudeau, Army research and development chief, indicated that one-sixth of the arms stockpiled for the Soviet divisions facing those of the Western powers in Europe are chemical weapons (W. Post 4-6), and that "... Soviet forces are trained in their use. . ." At the same hearings Herbert F. York, Pentagon director of research and engineering, said that he believed the Russian "are working considerable harder than we are" on chemical and biological warfare and asked that appropriations for such work be boosted from the present \$42 million to \$53.3 million next year.

in pretty much the same broad statistical sense as by fallout. One medium-sized war anywhere in the world in the next 50 years, or the failure to prevent one major famine, would do more damage to life than fallout will.

"The second thought is that fallout is not precisely the major issue with regard to bomb tests. Behind this worry lies the much greater fear of nuclear war, and if we are truly concerned about war, then let us by all means use all our wisdom in going after that subject directly."

John Buck

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RADIATION REPORT

(Continued from Page 1)

permit an estimate of the magnitude of the life shortening effect in man.

An increased incidence of leukemia, a relatively rare disease in many, has been found in population groups such as atomic bomb casualties or those chronically overexposed.

Small chronic radiation overexposure results in a gradual reduction in number, motility, and viability of sperm.

In animals, doses of 100-300 r produce a series of malformations in embryos which depend on the state of embryonic development at the time of exposure.

Committee on Meteorological Aspects

At the present time, delayed fallout from the stratospheric reservoir is the major source of airborne artificial radioactivity.

Committee on Effects of Atomic Radiation on Agriculture and Food Supplies

The production of radiation-induced mutants of plants has placed a new tool in the hands of plant breeders, supplementing but not displacing conventional crop improvement methods. With the possible exception of poultry, there seems little hope of genetic improvements in farm animals through radiation-induced mutants.

Although the present radioisotope levels in foodstuffs are low, it is the cumulative and retained isotope burden in man that must be considered. It is certain that all living things, man included, now have a radioactive body burden higher and different from that of the pre-atomic era.

Substantial progress has been made at the technical level toward understanding the mechanisms involved in entry and uptake of fallout elements into plants, their accumulation in those parts used for food by animals and man, and their retention and distribution in animals and man.

Committee on Disposal and Dispersal of Radioactive Wastes

Methods have been developed for the removal of major portions of the activity from many low-level wastes so that large volumes of liquids can be safely discharged to the environment. Existing treatment systems have satisfactorily handled intermediate-level wastes.

High-level wastes are produced primarily during the chemical processing of spent reactor fuels. About 65 million gallons of these wastes are now held in underground tanks at AEC storage sites. It is generally agreed that tank storage is not the ultimate solution to the waste problem, but will always form a part of any disposal system.

Committee on Oceanography and Fisheries

Present information indicates that limited quantities of radioactive materials can be safely released into the oceans.

NUCLEAR POWER TOO EXPENSIVE

The hard economic facts of life are reflected in a slow-down on the rate of development of plans for using nuclear fuel to produce power (N. Y. Times 4-19). The European Atomic Energy Community (Euratom) has only one plant under construction (north of Naples) although five were proposed last year under a Euratom-U.S. treaty. It is predicted, however, that despite present surpluses of coal and increasing supplies of oil and natural gas, electricity from nuclear plants will be needed within the next twenty years. By 1980, Euratom could build 250 nuclear power plants that would provide more power than the total presently available from all conventional sources. Immediate prospects for practical utilization of nuclear fuel for propulsion of merchant ships are also dim because of costs. John H. Lancaster of Bethlehem Steel predicts that nuclear propulsion will not become common "before economical fossil fuels are unavailable" and those should last until 2050. (N. Y. Times 4-30.)

U.S. Aid to Yugoslavia and France. Of great interest is the progress being made toward an understanding by which Yugoslavia may become the first Communist country to purchase a nuclear reactor from the United States (New York Times 3-31). A five-man Yugoslav delegation toured American atomic centers last month and expressed a desire to purchase a small reactor for research purposes with financial assistance from the U.S. through the International Atomic Energy Agency. A definite agreement has been reached under which the U.S. will deliver over 60 pounds of enriched uranium 235 to France to permit her to proceed with experimental work on an atomic reactor for submarines (New York Times 4-6).

The FAS is a national organization of scientists and engineers concerned with the impact of science on national and world affairs. The NEWSLETTER is prepared in Washington by FAS members. The staff for this issue: EDITORS: E. Shelton, J. Edgcomb, E. Korn. WRITERS: J. Edgcomb, B. Wright, F. Kameny, E. Kravitz, E. Korn, V. Lewinson, and F. O'Dell.

It is premature to decide whether any high-level wastes can or should be disposed of at sea.

The texts of the statements issued by each of the committees are, for the most part, relatively straightforward reporting of facts. There are, however, obvious overtones of uncertainty in connection with the reports of some of the committees, particularly those on Disposal and Dispersal and on Oceanography and Fisheries. In these cases insufficient information is so far available to permit definitive statements of fact and the impression left with the reader is dependent to a considerable extent on his previous exposure to earlier publications by various non-governmental organizations who maintain that the dangers of radioactive waste disposal are considerable, and improperly controlled at the present time (e.g. Bulletin of the Atomic Scientists).

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