MONTHLY STATUS AND PROGRESS REPORT

Division of Biology and Medicine

MONTH OF JUNE, 1953

Research Activities

Toxicity Studies at Argonne National Laboratory. (UNCLASSIFIED) Considerable research at Argonne National Laboratory has been aimed at counteracting the effects of toxic metals, both radioactive and nonradioactive, with special emphasis on plutonium and beryllium. Positive results have been achieved in the treatment of experimental plutonium and yttrium poisoning by zirconium salts and in acute experimental berylliosis by aurintricarboxylic acid (ATA). In recent tests with mice, zirconium citrate given before or within an hour after plutonium injections caused: a) a marked increase in plutonium excretion (approximately 1.3% to as much as 50-60% of injected dose); and b) a decrease in the amounts deposited in the bone (approximately 65% to 10% of the dose). The effect of yttrium is similar but less marked.

In mice injected repeatedly with an LD-95 of beryllium sulfate (0.7 milligrams-Be/kilogram body weight), it was found that administration of aurintricarboxylic acid following each beryllium injection not only protected the animals but enabled them to survive while still containing lethal amounts of beryllium. Studies elucidating the mode of action of ATA have provided a rational basis for the selection of other compounds of potential therapeutic value as well as an insight into some of the chemical mechanisms involved in metal-enzyme interaction.

Studies on Passive Immunity. (UNCLASSIFIED) Experiments have been under way at Brookhaven National Laboratory designed to test the effect of whole body gamma irradiation on immunity mechanisms. A Cobalt-60 source was used for the studies and radiation dosages of approximately 650 roentgens equivalent physical (the LD-50 being 750 reps) were administered to mice.

Evaluation of the results shows that while irradiation effectively destroys the immunity to pneumococcal infection even in the presence of abundant specific antibody, it does not abolish active immunity to the influenza Type A virus, nor the activity of tetanus antitoxin present at the time of irradiation. Taken together with other bits of evidence, this finding suggests that the lowered antibacterial resistance following whole-body irradiation is attributable primarily to the failure of phagocytosis by reason of the white cell deficiency, and that this phagocytosis may not

be necessary in antiviral immunity or in prevention of intoxication by neutralized tetanus toxin.

Photosynthesis and Antibiotics. (UNCLASSIFIED) At the Radiation Laboratory, University of California (Berkeley), the effects of antibiotics and other biological inhibitors on photosynthesis and dark CO_2 fixation are being investigated. The plant used for test is the alga Scenedesmus. The antibiotics used were dinitrophenol, chloromycetin, penicillin, aureomycin, terramycin, and several anti-folic compounds. While the anti-folics were negative, the dinitrophenol suppressed both processes. Penicillin and chloromycetin had no effect on CO_2 uptake, but apparently altered the pattern in dark fixation by decreasing the amount of radioactive malic acid. Aureomycin also inhibited dark CO_2 fixation at high concentrations but accelerated it at lower concentrations. Terramycin had a similar effect. These results should aid in interpreting the nature of both photosynthesis and the mode of action of antibiotics.

Uptake of Radioiodine in Humans. (UNCLASSIFIED) Recent investigations at the University of Iowa have been carried out to determine radioactive isotope uptake by the thyroid of human embryos. Dosages of 100 to 200 microcuries of radioactive iodine were given to pregnant women scheduled for therapeutic abortion. The embryos obtained were sectioned and autoradiographed. The human embryos showed thyroid uptake at four weeks, nearly one month sooner than was previously known. This finding is of primary importance to medicine in understanding transmission of this and other elements across the placental barrier; the element uptake by the human embryo; and in determining the amount of radio-iodine which may be given to pregnant women in terms of safety to the developing child.

Potassium Absorption by Tropical Crops. (UNCLASSIFIED) A project has been initiated with the University of Puerto Rico Agricultural Experiment Station (Rio Piedras, P. R.) on the relative rates of absorption of potassium from fertilizer and from soil. Potassium is one of the major crop fertilizing elements, however no data are available with regard to the relative absorption of potassium by tropical plants from fertilizer and from the soil to which the fertilizer is applied. Such knowledge will be of value in the study of cation absorption by plants, and in determining to what extent the addition of fertilizer or plant nutrients to agricultural soils is beneficial.

Algae Productivity in the Pacific. (UNCLASSIFIED) A cooperative contract has been executed with the University of Hawaii for research studies directed toward the utilization and evaluation of isotope techniques for determining algal productivity in the tropical Pacific. Research work recently reported indicates that the productivity of the sea can be estimated from measurements of CO_2 fixation by sea water samples collected over a large area. These studies are of interest in yielding significant information relating to the mechanics, quantity, and rate of carbon being fixed through photosynthesis by the marine algae. The results are anticipated to give a better understanding of the potential productivity of the warm seas, and to extend the development of radioisotopes as useful tools in the study of biological processes.

Antibody Synthesis. (UNCLASSIFIED) In examining the incorporation of radioisotopically labelled amino-acids into blood proteins, a research group at the University of Chicago has made certain observations that have important implications in regard to the body's immunological reactions. The relative time-patterns of the appearance of the labelled groups in the blood proteins generally, as compared with antibodies produced in response to injected egg albumin, suggest that the antibodies are not formed merely by modification of pre-existing plasma globulins, but are synthesized independently. Furthermore, it appears that this synthesis begins almost at once, after injection of the foreign protein, so that considerable antibody has been formed before it becomes evident in the blood. This finding has led to a current search of the various tissues to locate the antibody during the early period of apparent latent production. There is also a possibility that a "pro-antibody" may thus be demonstrated.

Mineral Element Measurement in Tissues. (UNCLASSIFIED) At the Sloan-Kettering Institute for Cancer Research, a number of promising techniques are being developed for measuring mineral element concentrations in small fragments of tissue. Two of the general types of method involved are: a) Historadiography - soft monochromatic x-ray beams are passed through a thin section of tissue, and the transmitted radiation is recorded photographically. The pattern of the amount of absorption, as related to wave-length, identifies particular minerals in the various locations pictured; b) Fluorescense analysis - elements within very small bits of tissue, exposed to x-rays, absorb the rays and in turn emit lower-energy rays. The wave-lengths of these secondary rays serve to identify the elements responsible.

With improved instrumentation and technical procedures, it is likely that one or more of these techniques may greatly facilitate research on the biological role of important trace minerals.

Radiation Instruments Program

Testing of Radiological Instruments. (UNCLASSIFIED) An agreement with the National Bureau of Standards for the testing of radiation detection and measurement instruments and their component parts has been in operation since March 1951. Since that time 40 types of various radiation detection devices have been tested. These tests include experiments such as: calibration (including alpha, beta, gamma, and neutron), spectral dependency, temperature, humidity, shock, and vibration effects. Other relevant tests are also initiated when required. The instruments examined to date include special types fabricated in Commission installations, new samples appearing on the market which are purchased by the Commission for test purposes, and instruments submitted by private concerns or individuals exploring new and improved methods to detect and measure radiation. Upon completion of the tests, recommendations are made in the light of currently accepted standards and discussed with the originating groups. The results of each test are also presented in the National Bureau of Standards Testing Report. Through the Radiation Instrument Branch, highlights of specific important results are described in the publication Rs-Det which is issued and distributed to instrument personnel of AEC and its contractors, and other government agencies. Examples of testing activities during June are as follows: a) Parker Pen Company Film Dosimeter - In cooperation with the Office of Industrial Development a test was arranged of a small "locket sized" self-developing film dosimeter to cover spectral sensitivity, calibration and sensitivity dependance on developer temperature at NBS for Parker Company; b) Scintillation Counter Survey Meters - All presently available types of scintillation counter survey meters are being tested in order to determine electrical and radiation characteristics as well as mechanical and climatic tests to evaluate the merits of each instrument under simulated field conditions. The results are primarily of interest to the Geophysical Section of Raw Materials Division.

Civil Defense Activities

Inspection of Tornado Damage in Massachusetts. (UNCLASSIFIED) On June 9, 1953, in the late afternoon a tornado struck Central Massachusetts. It extended from Petersham to Wrentham moving along a path of about 60 miles which varied in width from several hundred yards to over a half mile. Most of the distance covered was over unoccupied land except for a number of isolated houses which if grouped together would have made a sizeable community. The towns of Holden, Shrewsbury, and Wrentham were in the path of the tornado and at about mid-length it passed over the northern part of Worcester.

Because of the possible similarity to bomb damage, Professor H. L. Bowman, Consultant to the Division, was requested to examine the area involved. Destruction in the area did not look unlike a bomb-damaged area, however the appearance was more like a high-explosive bombing incident than atomic due to lack of fire. The damaged dwelling units numbered about 4000, destroyed

homes estimated between 630 to 700, and property damage about $52,000,000. The damaged residences were almost all single family units. Many were literally demolished, others lost all or part of their leeward walls. Windward walls which remained standing were in many instances badly scarred by debris, leeward walls were stuccoed with mud.

Some of the damage observed confirms much that has been learned from bombed areas: a) the usual wooden-frame dwelling is inadequately anchored to its foundation; b) the walls of this same type structure are not tied together or to the frame. This is evident from the numerous cases where the atmospheric pressure within the structure pushed out a wall when the pressure on the leeward side of the structure fell below atmospheric; c) the safe place for personnel in a tornado - as in a bombing incident - was the cellar. In frequent instances the first floor remained intact when the upper portion of the structure was either severely damaged or actually carried away; d) few of the load-bearing brick-wall buildings which make up the majority of the structures in the older portions of our cities were in the path of the storm. Those which were exposed - Assumption College being the foremost example - fared badly; e) the steel frame of the shop of the Norton Company which was exposed did escape damage. The glass and corrugated asbestos siding on the most exposed corner shattered without dangerously loading the frame. The metal roofing was inadequately anchored to the purlins and a large area - perhaps acres - was stripped off and spread over the adjacent leeward area.

General

AEC Handbook on Transportation of Radioactive Material. (UNCLASSIFIED) Problems arising from the diversity of conditions encompassed in regulations for the shipment of radioactive materials have led to a proposal to establish uniform standards an procedures for use of the Operations Offices. Accordingly, the preparation of an AEC Handbook on the transportation of radioactive materials has been planned in cooperation with the Division of Construction and Supply. A committee meeting of Washington and Operations Offices representatives was held during May and June to discuss contents of the proposed Handbook, and also to draft recommendations for possible changes in Interstate Commerce Commission regulations. Consultation is available on this subject from the Bureau of Explosives of the Association of American Railroads. Interim meetings will be continued in July leading to final draft of the proposed Handbook.

Conference on Toxicity Studies. (UNCLASSIFIED) A steering committee on toxicity studies being conducted at the University of Utah met in Salt Lake City on June 17-19, 1953. These investigations include large-scale experiments with animals on the long-time toxic effects of plutonium, radium, and mesothorium. Serial injections of dogs with the elements have been under way, and discussions were held to develop and evaluate the various injection and analytical procedures required to correlate the results of this project. Since the animal colony is considered akin to humans in these studies, medical care comparable to that which would be accorded humans will be given the dogs up to the time of sacrifice or natural death.