A-670

CENTRAL FILES NUMBER
45-6-284

File

Those Eligible To Read the Attached

717375

Date (6-23-45)

Subject Research Program

(MUC-KSC 498)

Copy # 1 Stone

By Cole

To Memo

Before reading this document, sign and date below

Name	Date	Name	Date

This document consists of 3 pages and 0 figures. No. 1 of 5. Series B.

Series A: MUC-KSC-498
7 copies, not listed

SeriesB: 1, 2, 3, 4, 5, - R. S. Stone

[redacted]

RESEARCH PROGRAM

VI Biology and Medicine

There is a reciprocal relationship between nucleonics and research in biology and medicine which requires that both advance as rapidly as possible. On the one hand, the chance for living organisms to be affected by the release of nuclear energy has been increased enormously by the development of the fission chain reaction. Extensive knowledge of the nature and extent of the biological effects is necessary for the continuing and safe growth of nucleonics. On the other hand, nucleonics makes available new, better and more powerful means for following and modifying life processes. These tools will be used with increasing effectiveness in the investigation of fundamental biological and medical problems.

1. Uses of Biology in Nucleonics

A. Protection - The protection of personnel against injury by radioactivity has been one of the outstanding problems in the present development. The general problem of biological protection will continue and will increase in importance with development of the scientific, industrial and military aspects of nucleonics.

a. Tolerance - The present arbitrary standards of protection should be replaced by tolerance levels established on a scientific basis as soon as possible. As wide a variety of measurements as possible must be made of the effects of all significant radiations, radioactive and other toxic materials, at a wide range of dose levels and durations of exposure and observations, and much further work must be done on the translation of results from animal experiments to predictions of effects and tolerances for humans.

b. Diagnosis -More sensitive and more specific indices of early damage are urgently needed. Despite several years of intensive investigation, the white blood cell count is still the most sensitive diagnostic test, but its lack of specificity leaves much to be desired. The present studies on prophyrin metabolism and white cell chemistry should be extended and many other biochemical and hematologic approaches must be made.

[redacted]

c. Therapy - Means for the removal of deposited toxic materials must be discovered. Methods of treatment where damage has occurred are required. These problems must be approached by a continued emphasis on investigation of the metabolism of toxic materials and on the fundamental nature and extent of injuries produced in a variety of organisms.

B. Additional Military Aspects - In addition, the military considerations require a knowledge of the effectiveness of the release of nuclear energy in its various forms upon living organisms. Besides the hazards of dispersed fission products and plutonium, the effects of the pressure and radiation waves accompanying an explosion should be known. The possibility of the direct use of fission products in warfare should not be ignored.

Although much of this work must continue under pressue, it is obvious that it should expand into fundamental biological and medical studies as rapidly as support and security will permit.

2. Use of Nucleonics in Biology

Nucleonics has contributed two effective tools to research in biology and medicine; radioactive tracers and sources of radiation. The fission chain reaction makes some tracer materials and radiations more available and adds new ones.

A. Tracers - The experience of the past decade has demonstrated beyond question the necessity for radioactive tracers in biological and medical research. They have been usec extensively for: a. Tracing and analyzing exchange processes in the metabolism of normal chemical constituents without disturbance of steady state conditions; b. Investigation of absorption, distribution, deposition and excretion of rare, toxic and foreign materials.

It is obvious that there will be much wider use of tracers in such fields as intermediary metabolism, analytical biochemistry, special organ and tissue physiology. In addition, there will be many applications to plant chemistry, metabolism of micro-organisms and to the fields of agriculture, biological industry and public health. In the field of medicine the clinical diagnostic and investigative uses of tracers can be expected to become quite extensive.

The extent to which the above fields have been broadened by the use of a few isotopes, notably P^{32}, makes it clean that the progress to be made with C^{14} alone will represent a series of major advances in science.

B. Radiation Effects - Much further investigation is necessary to achieve an understanding of the fundamental nature of the effects of radiation on living systems. Along with this path of research, various radiations will be widely used to modify and so aid in the analysis of a wide variety of biological processes. These problems must be attacked from many points of view, among which the following seem foremost: Physiology, biochemistry and histology of higher animals; tissue metabolism and enzymes; cell division and general cytology; cell physiology; genetics; carcinogenesis; ageing; and radiochemistry of solutions.

C. Radiation Therapy - Clinical and therapeutic use of newly available radioactive agents can in some cases be made on the basis of present knowledge, and in many other cases will require extensive studies on the effectiveness and tissue distribution of the agents. These uses include; Activated gamma ray sources such as Ta^{182} and Co^{60} for radiography and therapy; pile neutrons, beta-emitting activated plaques, P^{32} and Sr^{90} for superficial therapy; internally deposited isotopes such as P^{32} and Sr^{89}; and internal deposition of chemical compounds of active isotopes or of materials which can be activated in situ by neutron exposure.