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OAK RIDGE NATIONAL LABORATORY

August 25, 1949

TO: Division Directors
Responsible Reviewers
Group Leaders

FROM: Edgar J. Murphy

RE: Unclassified Fields of Research

There is enclosed a revised copy of the document listing the approved fields of unclassified research at ORNL.

Edgar J. Murphy
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UNCLASSIFIED FIELDS OR TOPICS OF RESEARCH
IN ATOMIC ENERGY AT THE OAK RIDGE NATIONAL LABORATORY

Revised

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Unclassified Fields or Topics of Research - ORNL

FOREWORD

It is not intended that the establishment of unclassified areas of research will abrogate the usual public relations reviews of opinion papers. The inclusion of a program in an unclassified area of research does not necessarily preclude the declassification of reports on the work through the regular declassification procedure.

UNCLASSIFIED FIELDS OR TOPICS OF RESEARCH
IN ATOMIC ENERGY AT THE OAK RIDGE NATIONAL LABORATORY

Proposed Unclassified Fields of Research in Biology

All biological, medical, and health studies, excluding work on elements of atomic number ninety or above, are to be unclassified.

When, in the course of biological investigations, use is made of classified materials or methods, then the classification is determined by the classification of these materials or methods.

I. Cytogenetics and Mammalian Genetics - A. Hollaender, N. H. Giles, Jr.,
L. W. Russell, A. D. Conger

Research in this field is concerned principally with the cytological detection of chromosomal aberrations and the genetic detection of both gene mutations and chromosomal changes resulting from the exposure of various plants (*Tradescantia*, *Neurospora*) and animals (mice) to radiations.

II. Physiology and Pharmacology - H. I. Kohn

Research in this field is concerned with the following subjects:

- A. The effect of total body irradiation upon the chemical constituents of the blood of the rat.
- B. The influence of certain drugs upon total body irradiation effects.
- C. The effect of irradiation localized to the tail of the rat and to the skin.
- D. The influence of certain drugs upon localized irradiation effects.
- E. The effect of immunization upon the response of the rat to irradiation.

III. Microbiology - S. F. Carson, D. S. Anthony, M. Kuna

The general field of research in this laboratory consists of the following:

Studies on the physiology and biochemistry of microorganisms with the aid of carbon isotopes. Included in this general field are studies concerning bacterial enzyme systems; radiochemical methodology of C^{14} ; bioorganic and physical chemical aspects of organic compounds and systems encountered in the biochemical phases of research.

IV. Biochemistry - C. E. Carter, W. E. Cohn

A. The effects of radiation on intra- and extracellular proteolytic enzymes.

1. Studies on crystalline enzymes and synthetic substrates.
2. Studies on activity of tissue extracts.

B. The effects of radiation on the metabolism and physical chemistry of nucleic acids and nucleoproteins.

C. Analytical chemistry of proteins and nucleic acids.

V. Radiation and Cytoplasmic Inheritance in Paramecia - R. F. Kimball

The group working on radiation effects on Paramecia has as its primary aim the study of the action of radiation on the cytoplasm and a comparison of this action with that on the nucleus. The cytoplasmic changes which are of most interest to the group are those which involve cytoplasmic elements concerned with inheritance. The procedure is to irradiate the animals and analyze by biological techniques the effects produced. The radiations so far employed have been X-rays, beta rays from P^{32} plaques, and ultraviolet. It is possible that pile radiations may be employed, but there are no plans to do this in the immediate future.

VI. Radiobiochemistry - C. W. Sheppard

The radiobiochemistry group is interested in developing the techniques of radiochemistry and their application to various biological problems.

The program at present:

- A. A study of the factors involved in the determination of absolute disintegration rates.
- B. The accurate measurement of absorption curves and deviations therein which result from alternations in sample mounting and geometrical relations between the source and the counter.
- C. The adaptation of the 100% geometry high pressure gamma chamber to the quantitative determination of beta emitters through Brehmstrahlen.
- D. A study of the properties and development of handling techniques for surface exposures using active materials.

VII. Radiation Bacteriology - E. H. Anderson

The radiation bacteriology group is engaged in research on the effects of external radiation on bacteria and bacteriophage. The program to date has been concerned with:

- A. A study of the inactivation of Escherischia coli by beta radiation, using activated phosphorus impregnated bakelite plaques as a source of external radiation.
- B. A study of the ability of external beta radiation to produce biochemical- and bacteriophage-resistant mutations in Escherischia coli.
- C. An analysis of the biochemical mutant produced to determine if a correlation exists between the inability of the mutant to synthesize specific growth factors and the inability of bacteriophage-resistant mutants to synthesize specific bacteriophages.

VIII. Biophysics - Wm. Arnold, W. G. Stone, A. S. Holt, C. W. Sheppard,
S. Benzer, R. Koza

This group is concerned with the following problems:

- A. A study of the process of photosynthesis and the effects of radiations on photosynthetic organisms.
- B. The exchange of potassium between the erythrocyte and serum by means of radioactive tracers.
- C₁. The development of a device for the determination of isotopic ratios in samples of oxygen and nitrogen.
- C₂. The development of a method for the rapid and precise determinations of oxygen tensions.
- D. Setting up and using the ultraviolet microscope so that the ultraviolet absorption spectra can be determined for parts of a single cell.
- E. A study of the effects of radiation on bacteriophage.

IX. Biological Synthesis - G. R. Noggle, R. Bolomey

- A. Studying the metabolism and physiology of plants, using unclassified radioisotopes as tracers.
 - 1. These studies will involve the use of such radioisotopes as C¹⁴, P³², S³⁵, and isotopes of the more common elements.
- B. Production and isolation of labeled biochemicals from plants, yeast, and other microorganisms. C¹⁴ will be used in most of these investigations.

Proposed Unclassified Field of Research in Chemistry

I. Nuclear and Chemical Properties of the Heavy Elements and of Chemically Related Elements - K. A. Kraus, R. W. Stoughton, C. H. Secoy

The basic chemistry of all elements of atomic number below 90 if not restricted by 10-210 through 10-213 and Table A of the Declassification Guide shall be considered unclassified. Analytical procedures and techno-

logical chemistry of all elements are not included in the above.

The present program in this field is as follows:

- A. Chemistry of heavy elements in solution and comparative studies with analogous elements.

II. Nuclear and Chemical Properties of Elements in the Fission Product

Region - A. R. Brosi, G. W. Parker, H. A. Levy, G. E. Boyd

Basic chemistry of the fission products, identification and characterization of the fission products, except neutron physics of classified substances.

The program presently under way in this field involves study of the following topics:

- A. Neutron cross sections of the unclassified fission products.
- B. Short-lived, high energy fission products, their isolation, identification, decay scheme, etc. Also, decay schemes in some other cases; i.e., fission products.

III. General Nuclear Chemistry - G. E. Boyd, G. W. Parker

Characteristic decay schemes, radiation energies, half-lives, etc., of the radioisotopes.

The present program in this field may be outlined as follows:

- A. Characteristics of radioisotopes in general.
- B. Characteristics of Elements 43 and 61.

IV. Bio-Organic Chemistry - C. J. Collins

The organic group is engaged in work on the chemistry of organic compounds containing Carbon 14. Four general problems are under consideration:

- A. Synthesis of low molecular weight intermediates containing Carbon 14.
- B. Synthesis of complex materials containing Carbon 14.

- C. Study of reaction mechanisms with Carbon 14, including degradative procedures.
 - D. Development of analytical methods for compounds prepared within the group.
- V. Applied Nuclear Chemistry - W. H. Baldwin, G. E. Boyd, J. A. Swartout
- Basic chemistry of specific radioisotopes of atomic number less than 90, except that information regarding the large-scale production of specific radioactive fission products and the technology of classified materials shall still be considered as classified. Motivation for project interest and the possibility of large-scale separation shall not be disclosed.

The following problems in this field are presently under consideration:

- A. Rare earth and fission product separations on a high activity scale.
 - B. Preparation of pure rare earths.
 - C. Separation of Hf from Zr.
 - D. Electrochemical separation of fission products.
- VI. Physical Chemistry and Chemical Physics - R. S. Livingston, E. H. Taylor
G. H. Jenks

Extra-nuclear physics and basic chemistry of elements of atomic number less than 90 shall be considered unclassified.

The following program is now in effect:

- A. Determination of nuclear spins by microwave techniques.
- B. Molecular spectra of heavy (less than 90) and rare earth elements.
- C. Molecular beam experiments in chemical kinetics, including analysis by neutron activation.
- D. Determination of the energy of decay of nuclear reactions by calorimetric measurements.

VII. Physical Measurements and Instrumentation - L. T. Newman, C. J. Borkowski

The use and development of instruments for laboratory work.

In this field the following activities are currently being pursued:

- A. Electron and optical microscopy.
- B. Electronic instrument development.
- C. Use of X-ray diffraction in determining crystal structure of elements of atomic number less than 90 and high temperature phase transitions.

Proposed Unclassified Fields of Research in Health Physics

It is proposed that the following fields of Health Physics, as herein described, shall be designated as unclassified areas of research. Since it is believed that the relations of these fields to classified information are, in general, incidental, it is not considered necessary to define them as closely as would otherwise be necessary.

I. Research and Development Related to Instrumentation for the Detection and Measurement of Radioactive Materials or of Ionizing Radiations -

Wm. M. Hurst

All work in this category shall be considered as unclassified, except (1) when utilizing classified information, or (2) when performed solely for the purpose of obtaining classified information. Fission chambers will not be included. Problems of interest are:

- A. The development of instruments for the detection and/or measurement of various types of radiation, with reference to one or more of the following characteristics:
 - 1. Sensitivity.
 - 2. Minimum energy dependence.

3. Maximum longevity with minimum maintenance requirements.
 4. Dependability and overall accuracy.
 5. Convenience in use.
 6. Economy of production.
 7. Versatility of application.
- B. The development of instrumentation for the detection and/or measurement of the activities of radioisotopes in air, water, or other materials; on surfaces; or isolated and collected for the purpose. Instrumentation characteristics of interest may be selected from the list given in the preceding paragraph.

II. Interaction of Radiation with Matter

A. Experimental - Francis J. Davis

Problems of interest fall into the following categories:

1. Basic principles of detection of radiation, primarily for application to problems of instrument development.
2. Interaction of radiation with simulated or phantom body tissues, to assist in the evaluation of radiation damage to tissue under various conditions.
3. Absorption or degradation of radiation except neutrons by shielding materials of atomic number less than 90, to provide information of value in designing or evaluating protective radiation shields.
4. Experimental work which might provide a basis for a more effective theoretical approach to items 1, 2, or 3 of this paragraph.

B. Theoretical - Jacob Neufeld

Application of physical principles and mathematical methods to the categories listed in II, A above.

III. Detection and Measurement of Radioisotopes in the Human Body - L. B. Farabee

Problems of interest fall into the following categories:

A. The development of methods of isolation from body fluids and quantitative measurements of activities of the various radioisotopes of atomic number less than 90.

B. The development of any other methods for detecting or estimating quantities of radioisotopes within the body. Isotopes of interest will not fall outside the limits defined in Paragraph III, A.

IV. Permissible Doses of Various Radiations and Probable Biological Effects of Chronic or Critical Overdosages - C. H. Perry

Critical surveys and applications of existing relevant radiological, biological, chemical, and physical information; and encouragement of laboratories within and without the AEC to acquire experimentally such needed information as is not available. The radioisotopes to be included in this field are those mentioned in Paragraph III, A. Publications will be classified in accordance with the security classification of the materials studied and with the classification of the work.

V. Disposal of Radioactive Wastes - Roy J. Morton

Included in this field is all research directed toward assessing and/or controlling biological hazards resulting from the release of radioactive materials of atomic number less than 90 from operations incidental to peacetime production and use of radioactive materials. Included is the release

of radioactive wastes into the atmosphere or into a drainage system; into sewage or water systems; or burial of radioactive materials in the earth.

Specific problems are:

- A. Dispersion of air-borne radioactive materials by the atmosphere.
- B. Physical and chemical behavior of various radioactive materials in drainage and ground waters; in sewage disposal systems; and in water treatment plants.
- C. Biochemical and biological behavior of various radioactive materials in and effects on organisms or life in (1) a drainage system such as that of White Oak Creek and the Clinch and Tennessee Rivers; and (2) sewage disposal systems.
- D. Methods of detection of radioactive materials. This is covered in part by Section I (Instrumentation).
- E. Methods of removal of radioactive materials from waste waters, water supplies, etc.
- F. Methods of removal of radioactive materials from exhaust gases.

NOTE: Reports covering work in the above listed fields will be reviewed also to determine the advisability of release from the standpoint of public relations or military applications.

Proposed Unclassified Fields of Research in Metallurgy

I. Mechanical Properties of Metals - J. H. Frye, Jr.

Studies of tensile strength and other properties of metals of atomic number 89 or below.

No other unclassified fields of research in metallurgy are proposed at this time.

Proposed Unclassified Fields of Research in Physics

I. Neutron Physics - S. Bernstein

All nuclear properties of all isotopes except neutron physics of classified substances.

In this field of research the following problems are under consideration and investigation:

- A. Investigations of the lifetime of the neutron.
- B. Installing and using the Van de Graaff accelerator.
- C. Measuring cross sections as a function of energy with a neutron crystal spectrometer.

II. Neutron and Nuclear Physics - E. O. Wollan

All nuclear properties of all isotopes except those prohibited in Item 10-175 and Tables A and B of the Declassification Guide.

The program in this field of research at present covers the following studies:

- A. Neutron diffraction studies.
 1. Scattering cross sections and phase studies.
 2. Scattering data.
 3. Crystallographic applications of neutron scattering techniques.
- B. Neutron capture cross section studies.
- C. Low temperature studies with the helium liquifier and associated studies.
- D. Studies of short period decay schemes with the fast rabbit tube.
- E. Capture gamma ray studies with the cloud chamber.

III. Physical Electronics - W. H. Jordan

Physical instrumentation (except fission chambers) which may be of use in the laboratory or industrial practice of the country, except that care should be taken that the motivation for developing the instruments and the applications for which they were used are disclosed only when the application itself is declassified.

The program in this field of research includes the following phases:

- A. Research and development of all kinds of particle detectors.
 - 1. Scintillation counters.
 - 2. Geiger counters.
 - 3. Proportional counters.
- B. Electronic equipment associated with particle detectors.
 - 1. Amplifiers.
 - 2. Scalers.
 - 3. Coincidence circuits.
 - 4. Oscilloscopes.
- C. Research and development of radiation detection instruments.
- D. Nuclear physics research, except neutron physics of classified substances.
 - 1. Capture gamma rays.
 - 2. Study of short-lived isomers.

IV. Physics of Solids - M. A. Bredig

Physical measurements and studies of physical characteristics of solid materials, except that the effect of radiation on the structural properties of reactor materials and on all accessory reactor equipment of importance shall be classified.

The program of study in this field includes the following topics:

- A. Growth of metallic crystals (the metallurgy of elements listed in Table A of the Declassification Guide shall not be revealed).
- B. Speed of sound in different materials to find Young's modulus.
- C. Effects of radiation on semi-conductors.

V. Mathematics and Computing - A. S. Householder

Pure and applied mathematics including computation methods, provided that it does not reveal information on the theory of the fission process, the theory of weapon physics, and reactor and neutron diffusion theory.

The following are typical problems which have recently been under consideration in this field:

- A. Solution of Milne problem.
- B. Gauss-Seidel iteration.
- C. Internal conversion calculations.
- D. Computation of preliminary constants which are functions of Z, K, and J for elements of atomic number less than 90.

VI. Theoretical Physics - M. E. Rose

All phases of theoretical physics, except that the theory of the fission process, the theory of weapon physics, reactor and neutron diffusion theory are still classified and shall not be considered unclassified under this program.

Recent problems which have been under consideration in this field include:

- A. Nuclear physics except for classified substances.
 - 1. Nuclear spins and nuclear forces.
 - 2. Beta disintegration theory.

3. Disintegration of the deuteron by particles and by electromagnetic radiation.
 4. Diffraction of neutrons and electrons by nuclei.
 5. Range studies of charged particles.
 6. Theory of nuclear magnetic moments.
 7. Theory of binding energy.
 8. Theory of multiple scattering.
 9. Interaction of nuclei and mesons.
 10. Theory of nuclear measurements.
 11. Theory of deuterons.
 12. Nuclear radiation lifetime.
 13. Angular distribution and angular correlation problems.
- B. General quantum mechanics.
1. Internal conversion.
 2. Energy loss and scattering of fast neutrons.
 3. Pair formation and annihilation.
 4. Solid state theory (vibration spectrum, electrical, and magnetic properties).
 5. Properties of matter at low temperature.

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