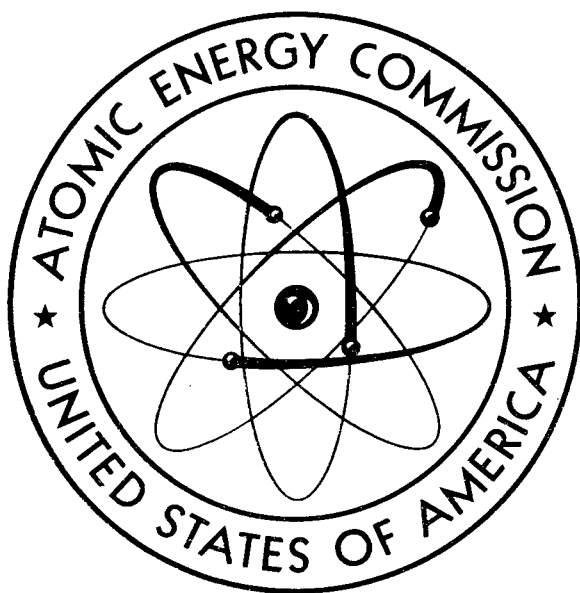


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Radioisotopes in the Biological Sciences

An Annotated Bibliography
of Selected Literature

Compiled by
Helen L. Ward

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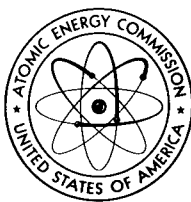
TID - 3585
Biology and Medicine
(TID-4500)

RADIOISOTOPES IN THE BIOLOGICAL SCIENCES

An Annotated Bibliography of Selected Literature

Compiled by
Helen L. Ward

April 1967



UNITED STATES ATOMIC ENERGY COMMISSION

Division of Technical Information Extension

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ABSTRACT

This bibliography contains a total of 959 selected references on the use of radioisotopes in biological research. These references were selected from the scientific literature published during the period 1958-1963. Author, isotope, and report number indexes are included.

INTRODUCTION

The use of radioactive isotopes as tracers has made possible great advances in biological research. Since the behavior of the radioisotope is identical with that of the stable isotope of the same element, and since it is possible to detect radiations emitted by the isotopes, many studies can be made which would not otherwise be possible.

The selective absorption of iodine by the thyroid gland permits studies of thyroid function. Radioactive iodine (I^{131}) has been used for this purpose as well as for the diagnosis and treatment of thyroid disorders. Iodine-131 has also been used in labeling rose bengal, a dye employed in studies on liver function. In addition to physiology, many other biological sciences, such as cytology, ecology, entomology, genetics, immunology, and nutrition, have been advanced as a result of the availability of radioisotopes for research.

The major reference sources for this bibliography were: Nuclear Science Abstracts, The Bibliography

of Agriculture, Biological Abstracts, Chemical Abstracts, and Index Medicus. The period covered was 1958 through 1964.

Reprints of the journal articles cited in this bibliography are not available from the Atomic Energy Commission but should be obtained through regular library sources.

The following bibliographies are useful in conjunction with the present publication: Radioisotope Techniques in Biological Sciences, TID-3512; Radioisotopes in Medicine, TID-3514; Radioisotopes in Animal Physiology, TID-3515; Physiological Studies Employing Radioisotopes, TID-3515(Suppl. 1); Radioisotopes in Medicine, TID-3077; The Effects of Radiation and Radioisotopes on the Life Processes, TID-3098; Biological Effects of Ionizing Radiation, TID-3097.

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GENERAL STUDIES

1 APPLICATIONS OF RADIOISOTOPES AND RADIATION IN THE LIFE SCIENCES. Hearings before the Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Seventh Congress, First Session, March 27, 28, 29, and 30, 1961. (United States. Congress. Joint Committee on Atomic Energy). 519p. \$1.50(GPO).

Separate abstracts have been prepared on 29 statements and papers presented.

2 (ORNL-3492(p.81-95)) RADIOACTIVE WASTE AREA AND RADIATION EFFECTS STUDIES. S. I. Auerbach, D. A. Crossley, Jr., P. B. Dunaway, et al. (Oak Ridge National Lab., Tenn.).

In dosimetry studies, miniature metaphosphate glass rods are being used to estimate absorbed dose in air and in the plants and soils of White Oak Lake bed. Combined beta and gamma doses in the top inch of mineral soil ranged from 20 to 25 rads/day on the northwest edge of the lake bed where Ru^{106} seepage from higher ground is appreciable. Absorbed doses in air at the surface of marsh plants (*Typha latifolia* L.) in this area ranged vertically from 6.2 rads/day at ground level to 2.8 rads/day at 5 ft above the ground. Absorbed doses in stem tissue of these plants were 23% higher due to absorbed radionuclides, principally Ru^{106} . The dose to root systems was three to seven times higher than the dose to shoot components. In food-chain studies of cotton rats maintained in pens on White Oak Lake bed and feeding on native vegetation, it was found that the concentrations of radionuclides in tissues are positively correlated with the corresponding concentrations in stomach contents and plants, the concentrations of radionuclides in tissues are not correlated with corresponding concentrations in soil, Sr^{90} in femurs is the only radionuclide in the tissues which was in greater concentration than in food or plants, and the placental and mammary barriers apparently were effective in reducing the concentration of Sr^{90} in fetuses and nursing young. Blood samples were taken from the original cotton rats one week before release into pens and at 4- to 6-week intervals thereafter. Blood analyses were also made on samples from rats born in the pens. Analyses of erythrocyte and leucocyte counts, leucocyte differential counts, hematocrits, mean corpuscular volumes, cell-volume distributions, and total serum solids were performed. These analyses showed no apparent effects of ionizing radiation in the blood of cotton rats maintained in the pens for this experiment. Studies on hematology of native mammals continued to support the previous discovery that the num-

ber of erythrocytes is inversely related to species size and that the mean erythrocyte volume is directly related to the species size. This relation was found to be present in the rodent families Muridae and Sciuridae, the shrew family Soricidae, and the primate family Cebidae. Seasonal effects on the blood of native mammals are being followed because of variations noted in cell counts and hematocrits of the blood of mammals trapped during various seasons of last year. Erythrocyte counts and hematocrits, for instance, in some species seemed to be higher in the winter than during other seasons. Use of trees as long-term monitors of radioactive seepage from underground waste pits was tested by sampling even-age pines growing around waste pit No. 5. Significant concentrations of four gamma-emitting radionuclides were found in these pine trees. These nuclides were Ru^{106} , Zr^{95} - Nb^{95} , Cs^{137} , and Ce^{144} . Concentration of Ce^{144} was between 100 and 200 μc per g of dry weight, which is the same as fallout levels. Cs^{137} concentration was uniform in all trees at 30 to 70 μc per g of dry weight. This amount could be attributed to blowout from three open pits which are due west of waste pit No. 5. Ru^{106} concentration varied from 0.02 μc per g of dry weight to fallout levels, which are 40 to 70 μc per g of dry weight. Twenty-three of the 73 trees collected showed a concentration of Ru^{106} greater than that which could be attributed to fallout or to blowout from the open pits. This higher concentration is attributed to seepage (and subsequent uptake by the tree) from waste pit No. 5. Five trees showed a concentration of Zr^{95} - Nb^{95} which was greater than fallout levels and also greater than Ru^{106} levels. The highest concentration of Zr^{95} - Nb^{95} was 771 μc per g of dry weight. Concentration of all the isotopes except Zr^{95} - Nb^{95} tended to be greater in needle material than in twig material. Fission foil threshold detectors were used to determine the fast-neutron dose absorbed by white oak acorns irradiated in the ORNL Graphite Reactor. The acorns were irradiated in a $17 \times 8 \times 4.5$ in. box of boron-carbide-impregnated Lucite, which absorbed thermal neutrons (over 50% of the total flux) but allowed fast neutrons to pass through the seed. Fission foils and pellets of S^{32} were placed under and on top of the sample to be irradiated, seed stacked to a depth of 4 in. After irradiation the foils and sulfur were counted immediately in the special fission foil counters of the Health Physics Division. Dose calculations were made according to the method of Hurst and Ritchie. The dose under 4 in. of acorns was 1755.8 rads/hr, whereas the dose over 4 in. was approximately 1250 rads/hr. Use of biological elimination of radioisotopes in insects as indirect measures of metabolism under field conditions was continued with emphasis on the influence of temperature on elimination rates. In geometrid caterpillars the biological half life of Cs^{137} was decreased by one-half for a 10° rise in

REFERENCES

temperature. Similar temperature-related trends were found for leaf beetles (*Chrysomela knabi*) and millipedes (*Dixidesmus erasus*).

3 UCRL-9135

California. Univ., Berkeley. Lawrence Radiation Lab. BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] DECEMBER 1959, JANUARY AND FEBRUARY 1960. J. A. Bassham, ed. Mar. 18, 1960. 52p. Contract W-7405-eng-48. OTS.

Study of soluble green leaf protein (Fraction I) is reported in which chloroplast fragments containing particles of 100-A diameter were observed. Further study of these particles to determine their function is in progress. Studies of steady-state photosynthesis and growth in *Chlorella pyrenoidosa* were continued, and experiments to determine rates of amino acid synthesis are in progress. Algae nutrient solutions for these experiments are being studied. Experiments are described in which the role of glycolic acid in photosynthetic carbon metabolism in CO_2 fixation is being studied. Glycolic acid was administered to *Chlorella* photosynthesizing in the presence of C^{14}O_2 . A companion experiment was run in which acetate was the source of C^{12} . Tabulated data are included which indicate that both glycolate and acetate reduce the total fixation. Glutamic acid degradation studies are reported which were carried out to learn the way in which this compound is formed when C^{14}O_2 is fed to photosynthesizing algae. Alternative degradation methods are discussed. In a study of the chemical effects of ionizing radiation on nucleotides, samples of uridylic acid were exposed to gamma radiation; resulting decomposition products are discussed. Experiments in which the degradation of toluene, formed when solid benzene is irradiated with C^{14} ions was partially completed. Energy values for carbon atom ring distribution are discussed and possible reactions are examined. A technique was developed for rapid processing of single samples in which C^{14}O_2 is bound, by means of a quaternary ammonium base, into a form suitable for liquid scintillation counting. The method was also extended for application to the assay of C^{14}O_2 in organic material combustion products. Experiments to test the hypothesis that increased training and more complete experience can influence rat brain cholinesterase (ChE) activity are described. Rats were subjected to experimental conditions, after which their cortical and subcortical ChE activity was determined. Analysis of results leads to the conclusion that environmental stimulation and training account for the difference in the pattern of ChE activity between the cortex and the subcortex. Data provide further indication that the cortical to subcortical ratio of activity is more sensitive to environmental influences than are the primary ChE measures. A previously reported experiment on the effects of D_2O on *Drosophila* was conducted in which the former results were not duplicated. Comparative data are included, and it is noted that the experiment is being repeated. (For preceding period see UCRL-9041.)

4 [USE OF RADIOISOTOPES IN STUDIES ON THE CHEMISTRY OF METABOLISM]. Statement of Dr. A. A. Benson (Pennsylvania State Univ., University Park). p.314-28 of "Applications of Radioisotopes and Radiation in the Life Sciences."

Uses of radioisotopes in studies of the chemistry of metabolism are reviewed. The radiochromatographic method of analysis is described in which paper chromatographic analysis is combined with tracer methods in studies of the dynamics of chemical reactions of the cell. Applications of the method in following the steps in photosynthesis and animal metabolism are described. Applica-

tions of activation analysis of biopsy samples in studies of animal metabolism are also described. This method eliminates the handling of radioactive materials. Studies on the identification and properties of surfactant compounds in plant cell membranes and protein-lipid interfaces only a few molecules thick are described which were made possible by the use of tracer methods.

5 AECU-4665

Sloan-Kettering Inst. for Cancer Research, New York. BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Semiannual Progress Report [for] Period: May 1, 1959-October 31, 1959. Dec. 1, 1959. 57p. Contract AT(30-1)-910. OTS.

A list of publications during the period and manuscripts in press is included. Progress is reported in the following studies: the electron spin resonance of free radicals in certain polycyclic hydrocarbon compounds which are carcinogenic, chemotherapeutic, or which have been irradiated; metabolic studies with calcium-45 and calcium-47 in bone disease; development of a whole-body scanner to improve resolution in isotope studies in patients; measurements of secondary electron spectra produced by internal isotope sources; *in vitro* studies of the metabolism of nucleic acid precursors in mammalian cells; developments of radioautographic technique for radioisotope tracer studies to demonstrate the incorporation of elements of compounds of biological interest into tissues; tracer studies in patients receiving labeled iodinated compounds, zinc-65, phosphorus-32, or gold-198; the design of a cesium-137 irradiator for laboratory animals, tracer studies on the growth inhibition of mammalian cells by selected antimetabolites; the interrelations of electrolyte balance and uric acid metabolism; a review of experience with iodine-131 in the treatment of hyperthyroidism and thyroid cancer; the synthesis of mercaptopurine nucleotides; physical and metabolic studies on purified ribonucleoprotein from rat liver; chemical studies of azapurine N-oxides; the direct thiation of heterocyclics with elementary sulfur; the physical characteristics of a number of nucleic acids; and the nature of the damage caused in mouse bone by exposure to 180 kvp x radiation.

6 TID-5955

Sloan-Kettering Inst. for Cancer Research, New York. BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Semiannual Progress Report for November 1, 1959 through April 30, 1960. May 1, 1960. 70p. Contract AT(30-1)-910. OTS.

An electron spin resonance spectrometer was placed in operation and used to examine a large number of carcinogenic aromatic hydrocarbons for negative free radical activity. Results are reported in studies on the metabolism of calcium-47 in patients with bone lesions; energy distributions of the electrons initially set in motion in water by gamma rays; tracer studies using carbon-14 to determine the effects of changes in thyroid function on the metabolism of hormonal steroids; growth inhibition of mammalian cells in tissue cultures which contain fluorinated pyrimidine nucleosides; and the localization of tritium-labeled nucleic acid precursors. Preliminary data are presented from a survey of approximately 55 patients who have received radioiodine in the treatment of metastatic thyroid cancer since 1944. The syntheses of mercaptopurine nucleotides was continued and preliminary experiments were carried out on the syntheses of *o*-2, 2'-cyclocytidine and 5-ribosyluracil. Physical studies on purified ribonucleoprotein from rat liver were continued. Attempts were made to obtain antibodies with

REFERENCES

purine or adenine specificity. Desoxyribonucleic acid was separated into five or six fractions by means of the Swag deproteinization method. Educational activities of the Sloan-Kettering Institute are reviewed.

7 (NYO-10152) BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Summary Progress Report, July 1, 1950–October 31, 1961. (Sloan-Kettering Inst. for Cancer Research, New York). Jan. 31, 1962. Contract AT(30-1)-910. 125p.

Progress is reported in kinetic studies of the metabolism of I^{131} and I^{131} -labeled compounds in man, the metabolism of Ca^{47} and Sr^{85} in patients with bone disease tracer studies on the metabolism of nucleic acid precursors and steroid hormones in man, measurements of electron spin resonance of free radicals produced in irradiated compounds of biological importance, measurements of secondary electron spectra produced by γ -emitting radioisotopes in water, radioautographic studies of isotope localization in tumors, bone marrow, and blood of leukemic patients, studies on the relationship of structure to biological activities and chemical properties of adenine and its monohydroxy derivatives, the development of techniques for the fractionation of nucleic acids, investigations on the physicochemical properties of nucleic acids, studies of the characteristics of the cytoplasmic ribonucleoprotein particles from mammalian tissue, and the quantitative measurement of the effects of x rays of different qualities on the bones of living mice and the correlation of these measurements with the amount of energy absorbed in the sensitive volumes of the bones. Educational programs are summarized and a list is included of publications during the period covered by this report.

8 (TID-15330) BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Summary Progress Report, July 1, 1950–October 31, 1961. (Sloan-Kettering Inst. for Cancer Research, New York). Jan. 31, 1962. Contract AT(30-1)-910. 125p.

Progress is reported in studies on the metabolism of iodine and I^{131} -labeled compounds in man, metabolic studies with Ca^{47} and Sr^{85} in patients with bone disease, intermediary metabolism studies with labeled nucleic acid precursors, and studies on the metabolism of steroid hormones in man. Electron spin resonance spectroscopy was used in studies of free radical production in irradiated compounds of biological importance, measurements were also made of secondary electron spectra produced by γ rays in water. The accomplishments of these, and supporting projects are summarized. A bibliography of major publications is appended.

9 ANL-5696

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1956. Mar. 1957. 122p. Contract W-31-109-eng-38. \$0.60(OTS).

Progress is reported in the following studies: measurements of antigenic specificity; the growth of mouse ascites tumor after serial transfer in rats; the effect of injected Y^{90} on the growth of ascites carcinoma in the mouse; the control of the mange mite on mice and dogs; the pathological effects of injected Sr^{90} in dogs and cats; factors influencing the formation of co-enzymes; the effects of x irradiation on blood volume and activity of the hematopoietic system in chicks; information content and biotology of the cell in terms of cell organelles as observed in *Paramecium*; the association of liver catalase with uricase-containing particulates in rats and mice; effects of

irradiation on spermatogenesis in grasshoppers; hyperpigmentation induced in the appendages of mice by exposure to γ radiation; the toxic effects of D_2O in mice and rats; the course of deuteration of mice drinking deuterated water; the effects of deuteration on the growth of ascites tumors in mice; the influence of paired doses of Co^{60} γ radiation on recovery from radiation injury; the survival of the four-day chick embryo following irradiation with fission neutrons; metabolism of organic acids by *Spirillum serpens*; the relationship of flick phosphene to eye phenomena; the metabolism of Ca^{45} and Sr^{90} in fish; the lack of protective effects of isomers of phenergan against radiation lethality in mice; the calibration of a combination electronic cell counter and size distribution analyzer used in classification of tumor cells in suspension; the biosynthesis of C^{14} -labeled reserpine and C^{14} -labeled gibberellins; the metabolic relation between adenine and sulfur amino acids in yeast; and tracer studies on arginine metabolism in rat livers. (For preceding period see ANL-5655.)

10 ANL-5732

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMI-ANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1957. July 1957. 203p. Contract W-31-109-eng-38. \$5.50(OTS).

Progress is reported in the following studies: the radio-sensitivity of paramecium; the sensitivity of germinating tobacco seed to light and x radiation; characteristics of mutants of *Escherichia coli*; the toxicity of Sr^{90} in dogs and mice; the effects of whole-body x irradiation on liver catalase levels in mice; the biosynthesis of methionine in bacteria; the effect of irradiation on liver tryptophan peroxidase activity in rats; the dissociation of insulin in pyridene-water and acetic acid-water solutions; the development of devices for dispensing microbial cultures rapidly and for counting bacteria automatically; the effect of 3-amino-1,2,4-triazole on intracellular distribution of catalase and uricase in mice livers; biochemical and morphological studies on nuclei from rat livers; electron microscope observations of the protozoan flagellate, *Peranema trichophorum*; the initial radiation syndrome of the pigeon and its effect on blood pressure and renal function; amyloid disease in irradiated and nonirradiated mice; genetic variation in the survival time of mice under daily exposures to Co^{60} γ radiation; the acute radiation response of the chick; the toxic effects of deuterium oxide in rats; the deposition of liver glycogen in x-irradiated guinea pigs; the influence of ultraviolet, x, and γ radiations on pigmentation in mice; an analysis of the mechanisms involved in radiation injury; the metabolism of boron by *Chlorella*; photoperiodism studies on *Xanthium*; the effect of gibberellic acid and photoperiod on indoleacetic acid oxidase in *Lupinus albus*; measurements of the neutron spectrum at the animal exposure position within the gamma-neutron radiation chamber at the CP-5 Argonne research reactor; the effect of single and spaced multiple doses of Co^{60} γ and fission neutron radiation on the incorporation of Fe^{59} into the rat hematopoietic system; the effectiveness of three radiation qualities on rats in terms of chronic radiation injury and mortality; the survival of giant amoebae after single exposures to Co^{60} γ rays and fission neutrons; the effects of injection of nonirradiated protoplasm on the recovery of irradiated amoebae; the development of a micropipette cutting device for cytological work; factors affecting granulocyte distribution; the effectiveness of injected solutions of the dipotassium salt of rhodizonic acid (K_2R) and the tetrasodium salt of tetrahydroxyquinone (Na_4T) for increasing the excretion of Sr^{85} in rats; the secretory activity of tissue mast cells; studies on the effect of deuterium oxide on tumor growth in mice; the development of an automatic scanner for the localization of tritiated compounds in

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paper chromatograms; the effect of neutron irradiation upon anhydrous Na_2HPO_4 and $\text{Na}_4\text{P}_2\text{O}_7$ in quartz, lime, and boron-free glass tubes; the stability toward x rays of sulfonium compounds as illustrated by *s*-adenosylmethionine; tracer studies employing labeled CO_2 on the kinetics of glycine metabolism in rat liver; the structural elements of uterine muscles; the preparation of tritium-labeled organic compounds by self-irradiation; the metabolism of alkylmercaptans in yeast; the metabolism of unsaturated fatty acids and cholesterol in rats; the biogenesis and translocation in plants of C^{14} -gibberellic acid; and the growth of algae in high concentrations of deuterium oxide. (For preceding period see ANL-5696.)

11

ANL-5841

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Mar. 1958. 204p. Contract W-31-109-eng-38. \$3.50(OTS).

Progress is reported in the following studies: factors affecting the production of antibodies in irradiated rabbits; the effects of irradiation on the serological activity of ovalbumin; factors affecting the growth of transplanted mouse ascites carcinomas in rats; the effects of strontium-90 on the life span and incidence of bone tumors in mice; the effects of irradiation on xanthine concentration and xanthine oxidase activity in chicken liver homogenates; the stability under various biochemical conditions and hydrolysis of *S*-adenosylmethionine; the biosynthesis and use as a growth factor substitute of *S*-adenosylmethionine by yeast mutants; design modifications of the Coulter counter, designed for red blood cells, for use in counting and sizing bacteria; electron microscope observations on fibrillogenesis in the regenerating achilles tendon of normal, scorbutic, and recovering guinea pigs; the response of mice to conditioning doses of whole-body gamma irradiation; the incidence of thymic lymphomas in mice exposed to low-dose daily cobalt-60 gamma irradiation; the relative effectiveness of cobalt-60 gamma rays and fission neutrons for producing duodenal damage in mice; genetic factors affecting tail spotting in mice; the effect of deuterium oxide on kidney function in rats; the influence of the endocrine glands on radio-induced hyperpigmentation in mice; the protective effects of injected bone marrow against radiation injuries in mice; the biological effects of neutrons in the epithermal region from 0.1 to 100,000 ev; the effect of whole-body neutron irradiation on the volitional activity of the mouse; developments in neutron-capture therapy; development of methods for estimating the body burden for various tracer radionuclides; the recovery of irradiated amoebae following injection of non-irradiated protoplasm; tracer studies employing phosphorus-32 in determination of the life span of neutrophils; the antipyretic effects of salicylates and aurintricarboxylic acid; the use of chelating agents in the treatment of manganese poisoning; the tissue distribution and toxic effects following long-term ingestion of deuterium oxide in mice; measurements of the radioactivity of typical foodstuffs after pile irradiation for the purpose of sterilization; the production of heat by the neutron irradiation of boron-free glass, lime glass, and quartz and its effect upon the condensation of phosphate; measurement of calcium-45 by liquid scintillation methods; tracer studies of protein turnover in rat liver; the effects of dietary cholesterol on cholesterol levels and cholesterol ester composition in liver and plasma of rats; and statistical studies of bone tumor death

rates, characteristics of the Argonne National Laboratory population, and inbreeding in the European bison population. (For preceding period see ANL-5732.)

12

ANL-6093

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. Dec. 1959. 110p. Contract W-31-109-eng-38. OTS.

Progress is reported in the following studies: the control of a scabies-like mange of rats and pinworms in mice; *in vivo* measurement of Sr^{90} in dogs; the effects of the chronic ingestion of Sr^{90} in mice; investigation of the tritium labeling of organic compounds by the self-irradiation method; the delayed effects of x irradiation in chickens; development of a new method for the assay of enzymatic activity of various homocysteine transmethylases; the use of a punched-card system for the location of filed prints of electron micrographs; the specific chromosomal control of the mass of the nucleolus and of the cytoplasm in plants; the effect of deuterium oxide on peripheral blood cells in rats; spermatogenesis in irradiated mice; the development of mathematical models for the maintenance and regulation of populations of blood cells of both erythroid and myeloid origin; the effect of boron on the uptake of iron, copper, manganese, and molybdenum in a monocotyledonous plant, the grass *Setaria spacelata*; the photoperiodic behavior of sunflowers; the morphology of the mitotic spindle and chromosomes as seen under the interference microscope; the thirty-day survival of female mice and rats given single whole-body exposures to fission neutrons; the effectiveness of combined therapy with cysteine, bone marrow cells, and streptomycin and of cerbaritol, a bone marrow extract, against radiation injuries in mice; the biological effects of gamma radiation in mice and fission neutrons in chick embryos; modification of the membrane filter technique for studies of radiation effects in bacterial spores; Sr^{85} retention by the rat as a function of age at injection; the kinetics of granulocyte production in the normal dog; sedimentation rate studies; the effect of three polyamino acid chelating agents on acute experimental lead poisoning in rats; the treatment of radiostrontium poisoning by means of a diuretic, acetazolamid; the preparation and properties of toxohormone from tumors; the potentiation of tumor radiosensitivity; the fractionation of cholesterol esters by silicic acid chromatography; and the bacterial metabolism of unsaturated fatty acids. (For preceding period see ANL-5916.)

13

(ANL-6264) BIOLOGICAL AND MEDICAL RE-

SEARCH DIVISION SEMIANNUAL REPORT, JULY THROUGH DECEMBER, 1959. (Argonne National Lab., Ill.). Dec. 1960. Contract W-31-109-eng-38. 189p.

Progress is reported on the following studies: the possible relationship between environmental Ra^{226} and incidence of bone tumors in human populations; the incidence of tumors in mice exposed to chronic γ irradiation; the effects of chronic γ irradiation on histology of testes cells; the effects of periodic exposure to γ radiation on the mortality of guinea pigs; determinations of the density of various mouse tissues; the synthesis of dimethyl formamide (DMF) and uranyl nitrate-DMF; an investigation of the role of the small intestine in acute radiation death in mice following exposure to fast neutrons or γ radiation; the effect of neutron dose on the incidence of mammary tumors and fertility of female rats and mice; measurements of Cs^{137} in samples of tea and human milk made with a γ spectrometer; the latency and growth of bone tumors induced by injected Sr^{90} in two strains of mice; histopathologic changes

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in the skeleton of mice following injection of various doses of Ra^{226} ; the development of mathematical models of cellular populations; reaction mechanisms in the response of chicks to radiation injuries; cell generation times in *E. coli*; the demonstration of infective organisms living in the cytoplasm of *A. proteus*; electron microscopic study of the fine structure of fat cells as related to structure; the effects of enzymes on induction of bacteriophage of *E. coli*; lipid metabolism and the isolation, fractionation, and analysis of cholesterol esters obtained during turnover studies; tracer studies on the role of urea in nitrogen metabolism using deuterium-labeled urea in which free energies of formation for deuterio-urea were determined; the participation of metal ions in transmethylation activity of enzymes in microorganisms; the effects of ultraviolet irradiation on yeast cells; the effects of thiol compounds on mitochondrial swelling; the effects of photoperiodism on flowering of xanthium; the effects of concentrations of 30 to 50% of deuterium oxide in drinking water on cells of male reproductive organs in mice and dogs and reproductive potential of male mice; the use of tritiated thymidine as a tracer in cell renewal in acute and chronic myelogenous leukemia; the loss of mutagenic potential in chemostat cultures of *E. coli*; radioinduced recessive mutations in mice; the demonstration of a recessive mutation in *Drosophila*; the pathology of ectromelia (a virus disease) and pseudomonas infections in mice; the effects of x, γ , and neutron irradiation on the formation of bacterial endotoxins in mice; the radioprotective effects of injected protoplasm in amoebae; the effects of chelating agents on the removal of monomeric and polymeric thorium in rats; the relationship of plutonium removal to tumor incidence in mice; the effects of chelating agents on the removal of monomeric and polymeric plutonium in mice; and the use of tritiated thymidine to measure the growth of tumor metastases in mice. A list of publications during the period is included. (For preceding period see ANL-6200.)

- 14 BIOLOGICHESKOE DEISTVIE PADIATSI. VYPUSK 1. (Biological Effects of Radiation. Issue No. 1). Lvov, Publishing House of Lvov University, 1962. 104p.

Thirteen articles are included on radiation effects on growth, development, and metabolism in animal and plant organisms. Biochemistry, cytology, and effects of ionizing radiation in agriculture and crop improvement are also discussed.

- 15 UCRL-3758
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]
JANUARY, FEBRUARY, MARCH 1957. Apr. 19, 1957.
37p. Contract W-7405-eng-48. \$0.30(OTS).

Progress is reported in the following studies: the morphology of an osteogenic sarcoma transplantable in rats; the metabolism of Ca^{45} in an osteogenic sarcoma; the induction of mammary tumors in rats following the injection of At^{211} ; radioinduced changes in oxygen-saturated pepsin solutions and aqueous glycine solutions; and the development of chemical radiation detectors. Health chemistry problems and health physics activities for the period are summarized. (For preceding period see UCRL-3653.)

- 16 UCRL-3880
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]
APRIL, MAY, JUNE 1957. July 29, 1957. 33p. Contract
W-7405-eng-48. \$0.75(OTS).

Data are tabulated on the incidence of and classification of tumors induced in female mice following administration of $\mu\text{c/g}$ body weight of At^{211} . Progress is reported in studies on the radiation chemistry of proteins, formic acid, and acetic acid. The effect of dose rate in the radiolysis of aquo-organic systems was investigated. Radiobiological studies reported include back-mutation studies of irradiated yeast, studies of hypothalamic-irradiated rats, the effects of x irradiation on egg hatch and egg-laying in wasps, tracer studies on the rate of formation and life span of lymphocytes, and studies on the embryonic nucleoprotein fraction that stimulates growth in tissue cultures. Health chemistry and health physics activities for the period are summarized. (For preceding period see UCRL-3758.)

- 17 UCRL-8031
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]
JULY, AUGUST, SEPTEMBER 1957. Oct. 14, 1957. 19p.
Contract W-7405-eng-48. \$0.75(OTS).

Data are presented from studies on Sr^{90} metabolism in monkeys and the deposition of Ce^{144} in the developing fetal skeleton in rats. Progress is reported in the study of radiation-induced reactions of proteins in aqueous solution. The process of thermal-neutron-induced activation of indium foils was adapted to the measurement of fast neutrons. A radiation survey was made at the 184-inch cyclotron and recommendations were made regarding additional shielding. Routine health chemistry and health physics activities during the period are summarized. (For preceding period see UCRL-3880.)

- 18 UCRL-8265
California. Univ., Berkeley. Radiation Lab.
BIOLOGY AND MEDICINE SEMI-ANNUAL REPORT
[FOR] OCTOBER 1957 THROUGH MARCH 1958.
Apr. 25, 1958. 65p. Contract W-7405-eng-48. \$1.75
(OTS).

Data are presented from the following studies: the radiation chemistry of pepsin, gelatin, methanol, benzene, and hexanes; the effects of irradiation of the pituitary in advanced cancer using high-energy particles from the 184-inch cyclotron; applications of ion beams in biological studies; the metabolism of strontium-90 and its relation to calcium metabolism in rats; hematological effects of low-level radiation doses in man; the influence of diet on serum lipoproteins; development of simplified methods for the analysis of blood serum for lipid content; tracer studies employing iron-59 of red blood cell production and destruction and iron metabolism in a wide variety of blood disorders; tracer studies on heart function and blood circulation employing I^{131} ; applications of C^{14} in studies of leukocyte formation from which it was concluded that peripheral neutrophils have a 2-day life span, large lymphocytes a life span of 2 to 3 days, and small lymphocytes a life span of between 8 and 14 days; tracer studies employing P^{32} in studies of the phagocytic action of cells of the reticuloendothelial system; factors regulating the volume of the body fluids; and development of a method for determining estrogen concentration in urine. Radiation protection activities are summarized. Lists are included of reports issued and papers published during the period. (For preceding period see UCRL-8031.)

- 19 UCRL-8513
California. Univ., Berkeley. Lawrence Radiation Lab.
BIOLOGY AND MEDICINE SEMI-ANNUAL REPORT

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[FOR] APRIL THROUGH SEPTEMBER 1958. Oct. 21, 1958. 76p. Contract W-7405-eng-48. \$1.75(OTS).

Data are tabulated from studies of the long-term turnover rates for calcium-45 and strontium-90 in monkeys and rats. Progress is reported in studies on the thyroid uptake and mammary tumor incidence in female rats as a function of dose of injected astatine-211. Data are presented from studies on the radiation chemistry of solutions of pepsin, gelatin, chymotrypsin, yeast dehydrogenase, aqueous acetic acid-oxygen mixtures, oxygen-free formic acid solutions, and glycine-water systems at elevated temperatures. Encouraging results are reported following 340-Mev proton beam or 900-Mev alpha beam pituitary irradiation in patients with breast carcinoma, acromegaly, diabetes mellitus, and other conditions that are under endocrine control through mediation of the pituitary. Laboratory and clinical data indicating the degree of completeness of hypophysectomy are being collected on all patients. Studies were made of the thyroid function of animals subjected to intense alpha-particle or deuteron irradiation of the thyroid area. A method was developed for the separation of iodinated amino acids of the thyroid, and the method applied in tracer studies of the effect of pituitary irradiation on thyroid function in rats. Progress is reported in studies on: the effects of radiation on the permeability of yeast cells to sodium and potassium ions; applications of neutron-activation analysis in determining the constituents in samples of biological materials; the chemical properties and physiological effects of human urinary erythropoietin; the development of analytical methods for the study of blood lipids; the role of heparin in lipid metabolism; the physiological role of lipoproteins in atherosclerosis and relationship to blood pressure and age; the effects of massive doses of a variety of estrogenic substances on the stimulation of liver phagocytic activity; the role of thymus in lymphocyte production; physicochemical studies of yeast metabolism; the effects of pH and anoxia on growth and x-ray sensitivity of *Escherichia coli*; biological measurements of aging of man; and genetic studies on *Drosophila*. Routine radiological monitoring activities are summarized. A list is included of publications and papers presented during the period. (For preceding period see UCRL-8265.)

20 UCRL-8988
California. Univ., Berkeley. Lawrence Radiation Lab. BIOLOGY AND MEDICINE SEMIANNUAL REPORT FOR APRIL THROUGH SEPTEMBER 1959. Dec. 1959. 91p. Contract W-7405-eng-48. OTS.

Progress is reported in the following studies: the ultrastructure of cells of yeast, diatoms, and Hela as observed with the electron microscope; the effects of pituitary irradiation on human metastatic mammary carcinoma and certain endocrine-controlled diseases, the response of breast cancer patients to changes in endocrine status, and the excretion of urinary estrogens in patients with advanced metastatic mammary carcinoma; the effects of irradiation on the response of isolated nerve fibers; the effects of radiation on phagocytic activity in the reticuloendothelial system; demonstration of a protective effect of intraperitoneally injected olive oil against radiation injury in mice; the physiological effects of transplantation of homologous tissues; biological effects of internally deposited radioisotopes; the incidence of mammary tumors in astatine-211 injected rats; the metabolism of fatty acids in humans; the pathology of atherosclerosis; coronary blood

flow; the effectiveness of human urinary erythropoietin in primates; determinations of protein-bound iodine in blood serum; the role of citric acid in bone physiology and its relationship to calcium metabolism; measurements of radioactivity in man using a whole-body counter; development of an infrared micromethod for serum lipid analysis and methods of gas-phase chromatography employing a strontium-90 radiation detector; the development of a method for the *in vivo* measurement of blood flow to the gastrointestinal tract; investigation of radiation-induced oxidation of aqueous glycine anhydride-oxygen solution and of aqueous protein-oxygen systems; reactions in the radiolysis of aqueous protein systems and in the irradiation of peptides in the solid state. Activities in the fields of radiation detection and protection during the period are summarized. A list is included of reports and papers prepared during the period.

21 HW-47500
General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.
BIOLOGY RESEARCH ANNUAL REPORT [FOR] 1956.
Jan. 4, 1957. 237p. Contract W-31-109-Eng-52. \$1.25 (OTS).

Late in 1956 a reorganization at Hanford disbanded the Radiological Sciences Department and transferred the Biology Section, with its name changed to Biology Operation, to the Hanford Laboratories Operation. Emphasis of the research program changed from being primarily Hanford oriented toward being more concerned with radiobiological problems derived from the general needs of radiation hazard control. Data are presented from the following studies: the effect of age on the absorption and skeletal deposition of P^{32} ; the effect of dietary Ca on the skeletal deposition of Sr^{90} ; the pathological effects of ingested Ru^{106} and Cs^{137} in rats, and the determination of permissible limits for Ru^{106} in drinking water; the toxic effects of continued dietary I^{131} in sheep; the development of a special metabolism cage for swine receiving radioisotopes; determination of the effects of a triple radiation assault in lambs; the effects of β particles on pig skin; the cutaneous absorption of Pu from a PuF_4 solution; the decontamination of animal skin contaminated with Pu by applying a plastic coating to the contaminated area and then pulling it off; the pathological effects of radioactive particles in the lungs of mice; the effect of CaEDTA on the radiosensitivity of yeast; and the uptake of Sr^{90} by plants from contaminated soil. A list of talks presented at scientific meetings and publications during the period is included. (For preceding period see HW-41500.)

22 (UCRL-9408) BIO-ORGANIC CHEMISTRY
QUARTERLY REPORT, JUNE, JULY, AND AUGUST 1960.
(California. Univ., Berkeley. Lawrence Radiation Lab.).
Sept. 22, 1960. 51p. Contract W-7405-eng-48. OTS.

Controlled experiments to confirm the effect of deuterium and tritium in causing a disjunction in *Drosophila* were carried out. Both deuterium and tritium have an influence, but whether the effect is synergistic or additive is not known. Studies of radiation effects on nucleotides continued with investigation of solvents for chromatography of irradiated nucleotides, analysis for sugars and phosphates, and ultraviolet absorption spectra of irradiated nucleotides. A study on inbred BALB/c mice showed that D_2O causes sterility in some inbred strains more rapidly and completely than in outbred strains. Research continued on enzyme distribution in rat brain with studies on the determination of hexokinase in rat brain and its relative activity in various areas of the brain and with a comparison of hexoki-

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nase activity to that of cholinesterase and lactic dehydrogenase. Conclusive proof was obtained that in Papaver somniferum thebaine is the first of the octahydrophenanthrene alkaloids to be formed and is converted by successive o-demethylations to codeine and finally morphine. Brief reports are given of investigations of high-carotenoid particles in spinach chloroplasts, Hill reaction activity of small chloroplast fragments, and factors affecting the permeability of Chlorella cells to metabolites of interest. Preliminary experiments with electron spin resonance measurements in photosynthetic systems are described. Electron transfer was studied in combining halogenated quinones with perylene, N,N,N',N'-tetramethyl-p-phenylenediamine, and N,N-dimethylaniline. A proportional counter was designed for detection of radioactive components in gas chromatography.

- 23** (UCRL-10156) BIO-ORGANIC CHEMISTRY QUARTERLY REPORT, DECEMBER 1961 - FEBRUARY 1962. (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Dept. of Chemistry). Apr. 3, 1962. Contract W-7405-Eng-48. 89p.

Progress is reported in investigations on the polymerization of formaldehyde, ultraviolet irradiation of aqueous HC^{14}N , radiation chemistry of nucleic acid constituents, oxidation of free sugars and aldonic acid derivatives by Acetobacter suboxydans, preparation and isolation of C^{14}O_2 ~ enzyme, metabolism of C^{14} -ribulose diphosphate by Nitrobacter agilis, C^{14}O_2 metabolism of Hordeum vulgare seedlings during the development of the photosynthetic apparatus, location and chemical characterization of RNA in the chloroplasts of Spinacea oleracea, inhibition of dark bleaching by stroma extracts and by inert gases, ESR studies on chromatophores from Rhodospirillum rubrum and on quantasomes from spinach chloroplasts, and phthalocyanine manganese and etio-porphyrin manganese complexes.

- 24** PALEOECOLOGICAL FACTORS IN THE SEA. Ralph Buchsbaum. (Univ. of Pittsburgh, Pittsburgh, Pa.). Annee biol. **33**, 283-5(1957). CA-52: 8398h.

- 25** UCRL-3836
California. Univ., Berkeley. Radiation Lab.
CHEMISTRY DIVISION QUARTERLY REPORT [FOR]
MARCH, APRIL, AND MAY 1957. June 28, 1957. 64p.
Contract W-7405-eng-48. \$1.25(OTS).

Progress is reported in studies in bio-organic chemistry, nuclear chemistry, and process chemistry. A method was developed for tracer studies with oxygen, using paper chromatography and proton activation of O^{18} to F^{18} . The procedure was applied in a preliminary study of the path of oxygen in green algae. The construction is reported of a modified design of a C^{14} respiration-pattern analyzer for humans. Data are included from preliminary studies using the apparatus. Progress is reported in studies on the luminescence spectrum of chloroplasts immediately after exposure to a flash of light; the radiation chemistry of benzene; the preparation of dry KC^{14}N ; the synthesis of labeled morphine; the demonstration of C^{14} respiration pattern abnormalities in diabetic rats; tracer studies on tissue distribution of diisopropylfluorophosphonate in rats; tracer studies on the incorporation of adenine- C^{14} into nucleotides and nucleic acids in rats; the excretion of cyanide- C^{14} in mice; tracer studies on fat metabolism;

the effect of γ radiation on photosynthesis and viability of Chlorella; the photosynthesis of lipids and pigments in algae; the radiation chemistry of trichloroethylene; determination of fission yield curves for the deuteron-induced fission of U^{234} , U^{235} , and U^{236} ; and determination of cross sections for deuteron (d, γ) reactions in uranium. (For preceding period see UCRL-3710.)

- 26** [RADIATION IN THE LIFE SCIENCES]. Statement of Dr. C. L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.).

Developments in applications of nuclear energy and its byproducts in biology and medicine during the past five years are reviewed. Topics discussed include the development and applications of whole-body radiation counters; the labeling of the thymidine molecule with tritium and applications as a tracer in studies on the production and fate of desoxyribonucleic acid; research in terrestrial ecology, the marine sciences, and the fate of radionuclides in man's environment; the mechanisms by which radiation produces genetic and metabolic effects and induces cancer; and the selective uptake of a variety of radioelements by plant roots and leaves, and the movement of these elements in the soil. Educational and training program development and expansion are also reviewed.

- 27** IODINE-129: ITS OCCURRENCE IN NATURE AND ITS UTILITY AS A TRACER. R. R. Edwards. Science **137**, 851-3(1962) Sept.

- 28** RADIOAKTIVE ISOTOPE IN KLINIK UND FORSCHUNG. III. VORTRAGE AM GASTEINER INTERNATIONALEN SYMPOSION, 1958. (Radioactive Isotopes in Medicine and Research. III. Contributions At The Gastein International Symposium, 1958). K. Fellinger and H. Vetter, eds. Munich-Berlin, Urban and Schwarzenberg, 1958. 371p.

The papers presented at the Third Gastein Conference and the discussions made on each paper are given. The subjects include "Hematological Investigations in the Clinical Application of Radioactive Gold Colloid," "The Effect of Whole Body Irradiation on Bone Marrow as Studied by Radioactive Iron Incorporation," "Affecting the Radioinduced Inhibition of DNA by Cysteine in Normal and Reduced Metabolism," "Use of Isotopes in Clinical Studies of Skeletal Metabolism," "Radiation Dosimetry Aspects of Bone Tumor Production," "Respiration and Fermentation in Cultures of Fibroblasts and HeLa Tumors," "Investigations on the Schizoid Problem with C^{14} -labeled d-Diethylaminelysergic Acid and C^{14} -labeled Succinic Acid," "Autoradiographic Investigations of Protein Metabolism in the Cells of the Central Nervous System of Rabbits and Rats," "Quantitative Determination of Iodine-Albumin Bonding in Tissues on a Radiohistochemical Basis," "The Kinetics of Blood Purification of Colloidal Suspensions as a Measurement of the Hepatic Circulation," "Studies of Liver Blood Flow in Man," "Radiogold and Bromosulfalein Clearance of Plasma as a Clinical Test of the Liver Function," "The Efficiency of Purification of the Human Liver with Respect to Colloidal Radioactive Gold (Au^{198}). Preliminary Study of a New Technique for the Measurement of the Purification Efficiency," "Measurement of Liver Blood Flow with Colloidal Radiogold (Au^{198})," "Advantage of Radioactive Labeled Substances in Clearance and Distribution Research," "A Method for the Determination of the Absolute Iodine Uptake in the Thyroid Gland and an Indirect Method for the Determination of the Concentra-

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tion of Inorganic Iodine in the Blood," "Hemodynamics: Interpreted by Means of Multiple Scintillation Detectors Placed Over the Anterior Thoracic Wall," "Diagnostic Value of Selective Quantitative Radiocardiography," "Iron Metabolism Studies in Liver Cell Damage," "Hypophysis and Iron Metabolism: V. Influence of ACTH on Rat Erythropoiesis," "Radioactive Tracer Studies of Red Cell Survival in Tumor Bearing Rats," "Radio Paperchromatographic Investigations on the Specificity of the Bonding of (Co⁶⁰)-Vitamin B₁₂ Analogs to Intrinsic Factor Concentrates," "The Life Span of Cr⁵¹-labeled Erythrocytes at Various Ages," "Hypophysectomy for Advanced Breast Cancer Using High Energy Particle Beams-Proton and Alpha Particles," "The Radiological Hypophysectomy by Implantation of Au¹⁹⁸," "Experiences with Yttrium-90 Hypophysectomy," "Analysis of the Behavior of I¹³¹-albumin in the Normal Subject and Nephrotic Patient," "A Practical Method for Plasma Albumin Turnover Studies," "Rapid Protein Breakdown in Idiopathic Hypoproteinemia," "Isotope Studies on the Regulation of Muscular Blood Circulation," "Diagnosis of Venous Return Flow Disturbances with Radioiodine Tissue Clearance," "Photo-scanning: A Preliminary Report of a Simplified Graphic Method for the *in vivo* Pre-operative Localization and Recording of Brain Tumors," "Probability of Interest of the External Detection by 'Bremsstrahlung' of Radiophosphorus P³² in the Organism," "A Comparison of the Tissue Distribution of Colloidal Yttrium-90 and Gold-198 in Mice after Intraperitoneal Injection," and "The Distribution of Radioyttrium and Rare Earths in Organism in Different Application Methods."

29 RADIOAKTIVE ISOTOPE IN KLINIK UND FORSCHUNG. Band IV. Vorträge am Gasteiner Internationalen Symposium 1960. (Radioactive Isotopes in the Clinic and in Research. Volume IV. Proceedings of the Gastein International Symposium, 1960). K. Fellinger and R. Höfer, eds. Munich-Berlin, Urban & Schwarzenberg, 1960. 393p.

Thirty four papers and the discussions following each are compiled. The papers were limited to the following subjects: (1) investigations of calcium metabolism and the location of bone tumors with Ca and Sr isotopes; (2) new methods of therapy with radioactive isotopes; (3) investigations on the structure of erythrocytes by *in vivo* measurements; (4) determination of the electrolyte content of the body and electrolyte exchange, as well as determinations of the total body and extracellular waters; (5) investigations of glucose and insulin metabolism by means of radioisotopes; and (6) the peripheral metabolism of thyroid hormones and iodated amino acids.

30 ISOTOPIC TRACERS. A Theoretical and Practical Manual for Biological Students and Research Workers. Second Edition. G. E. Francis, W. Mulligan, and A. Wormal. London, University of London, 1959. 544p.

A theoretical and practical manual on the use of isotopes in biochemical and physiological investigations is presented. The manual gives up-to-date and reliable data with regard to the physical characteristics of radioactive isotopes and radiations, the types of apparatus and equipment available, and the experimental techniques used in the biological isotope tracer field.

31 ELECTRON DISTRIBUTION IN SOME HIGH-ENERGY PHOSPHATES AND TRANSFER OF ENERGY FROM CATABOLISM TO ANABOLISM. Barbro Grabe.

(Univ. Stockholm). *Biochim. et Biophys. Acta* 30, 560-9(1958)(in English). CA-53: 6318i.

32

HEAVY WATER INHIBITION OF CELL DIVISION: AN APPROACH TO MECHANISM. P. R. Gross and W. Spindel. *Ann. N. Y. Acad. Sci.* 90, 500-22(1960) Oct. 7

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(ORO-358) FINAL SCIENTIFIC REPORT ON [MEDICAL APPLICATIONS OF RADIOISOTOPES]. P. F. Hahn (Meharry Medical Coll., Nashville). July 12, 1960. 42p. Contract AT(40-1)-269.

Results are summarized on 560 patients with malignant disease treated with radiogold or silver-coated radiogold colloids. Observations made in the course of the therapeutic management of chronic leukemias are included. It was concluded that a single intravenous administration of radiogold colloid offers as simple and satisfactory a method of treating leukemia as is available at this time. Results are reported from preliminary studies in dogs on the therapy of bronchogenic tumors. Attempts to induce tumors of the lung in dogs are reported. Studies are reported on the control of lymphatic drainage after pneumonectomy by the injection of silver-coated gold colloid. Experiences in the treatment of advanced bronchogenic carcinoma with radioactive colloids administered by the intrabronchial route are reported. Results are reviewed from long-term studies on the effects of Fe⁵⁹ and Fe⁵⁵ in dogs; intracavitary therapy with radiocolloids; the treatment of pleural effusions with silver-coated Au¹⁹⁸ colloids; the treatment of leukemia in mice with radioactive gold colloids alone and combined with other agents; tracer studies of phagocytic processes in the animal body; the distribution of gold in the central nervous system following the administration of radioactive colloidal gold; the tolerance to intraventricular injections of colloidal gold and to injections directly into the brain; the feasibility of nerve destruction by the intraneural and perineural injection of large doses of high specific activity radiogold colloids; the treatment of prostate and bladder carcinoma with radioactive gold; the development of cirrhosis and ascites in dogs following administration of colloidal radioactive gold; studies of protein deficiency in dogs which received chronic massive internal irradiation due to intravenous administration of radiogold; the prophylactic use of radiocolloids postoperatively to prevent seeding of cancer; studies of hepatic visualization following the administration of colloidal radiogold; studies on palladium colloids with antigenic protective colloid in an attempt to concentrate antigen in the reticuloendothelial system; and miscellaneous studies. A list is included of 76 publications resulting from this contract.

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HW-53500
General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.
HANFORD BIOLOGY RESEARCH ANNUAL REPORT
FOR 1957. Jan. 10, 1958. 227p. Contract W-31-109-Eng-52. \$3.50 (OTS).

Data are presented on the uptake, distribution, and turnover of radioelements in plants, animals, and communities; the biological effects of ionizing radiations on certain organs and organisms; and the effects of operations at Hanford on plant and animal life of the region. Factors that affect radiostrontium uptake and deposition

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in plants and animals were investigated, with special emphasis on the effects of calcium. Data are included from studies on the permissible limits for Cs^{137} ; the uptake of I^{131} by plants and animals; permissible limits for plutonium in drinking water; the hazards from the deposition of radioactive particles and factors affecting their removal; the mechanisms by which ionizing radiations cause biological effects; the effects of reactor effluent on plants and animals; and measurements of the concentration of radioelements from reactor effluent absorbed by plants and animals. (For preceding period see HW-47500.)

35 ORNL-2384

Oak Ridge National Lab., Tenn.

HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1957. Nov. 26, 1957. 131p. \$3.50(OTS).

Progress is reported in the following studies: the construction of a body burden counter which employs activation analysis to measure directly U^{235} injected in rats and mice; the tissue distribution of U^{233} in mice following ingestion of 0.12 μ c/day in drinking water for periods of from 30 to 120 days; the testing of an atmosphere exposure chamber; the tissue distribution of U in dogs following inhalation of uranium fumes or the ingestion of uranium oxides; development of a procedure for the radiometric determination of U in urine following ion exchange separation as a uranyl chloride complex; radiobiological-ecological studies on the drained bed of White Oak Lake, an impoundment used as a holdup basin for low-level radioactive wastes; the development of procedures for use in the collection of arthropods and insects; the effects of irradiation on population growth of *Collembola*, *Coleoptera*, and *Caloglyphus*; the uptake of fission product waste seepage by trees and smaller vegetation; a review of data on maximum permissible concentrations of radioisotopes for the human body; the tissue distribution of Sr^{90} and Y^{90} in mice; the spectrographic analysis of human tissues for trace elements; the performance of an aerosol generator for dispersing U aerosols; the development of radiochemical methods for the determination of trace amounts of fission products in water and soil samples; investigations of waste processing by evaporation, storage in deep wells and waste pits, adsorption on soil columns; solvent extraction, and sintering; assays of the soil movement and dilution of wastes from storage pits; and a survey of possible waste disposal sites. A review is presented of the Ichiban Project for the determination of the absorbed doses of fast neutrons and γ radiation received by survivors of the nuclear bombing of Hiroshima and Nagasaki. Data are included from a preliminary study of γ attenuation by Japanese house components. Applications of the information theory in studies of radioinduced tissue damage are discussed. A quantum theory for the dielectric constant of metals is presented and discussed. A procedure is described for the preparation of thin uniform sources for a beta-ray spectrometer. Studies on the theoretical physics of radiation dosimetry and the development of instruments for use as dosimeters are reported. Education, training, and consultation activities during the period are reported, and a list of publications during the period is included. (For preceding period see ORNL-2151.)

36 HW-54938

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES QUARTERLY

PROGRESS REPORT [FOR] OCTOBER-DECEMBER 1957. J. W. Healy, ed. Feb. 12, 1958. Decl. May 12, 1958. 43p. Contract W-31-109-Eng-52. \$6.30(ph OTS); \$3.00(mf OTS).

Progress is reported in the following studies: the effects of reactor effluent on aquatic organisms inhabiting the Columbia River; the effect of small daily doses of I^{131} on developing swine fetuses; the effect of dietary calcium levels on the uptake of Sr^{90} by lambs; the distribution of intravenously injected Zr^{95} in rats and cattle; the effects of treatment with diethylenetriamine pentaacetic acid on the bone absorption of plutonium in experimental animals; fission product metabolism in plants and animals; the effects of whole-body irradiation on gastrointestinal function in rats; the pathological effects of irradiated intestinal homogenates when injected intraperitoneally into normal rats; the distribution of inhaled or intratracheally administered particles of $Ru^{106}O_2$, $Pu^{239}O_2$, and $Sr^{90}SO_4$ in mice and dogs; the demonstration of malignant lung tumors in mice following the intratracheal administration of $Pu^{239}O_2$; the diffusion and transport of stack gases at distances up to eight miles from continuous ground sources; modifications in design and performance checks of radiation detection instruments for monitoring and dosimetry; the development of chemical dosimeters; and studies on ground waste disposal, the gelling of liquid wastes, and the flow of ground waters in the area. (For preceding period see HW-52866.)

37 HW-46333

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] July-September 1956. J. W. Healy, ed. Oct. 30, 1956. Decl. Oct. 2, 1958. 31p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Reorganization of Hanford Atomic Products Operation with the elimination of the Radiological Science Department as a separate organizational entity is reported. Organizational structure of the new Hanford Laboratories Operation is outlined. Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the effect of reactor effluent on aquatic organisms; the effect of nutritional state on thyroidal uptake of I^{131} in swine; the I^{131} concentration in fetal thyroids in sheep during various stages of gestation; the effects of whole-body x irradiation on the leukocyte count in sheep; the transfer of radiostrontium to sheep milk following oral ingestion; Pu absorption and metabolism in young rats; fission product absorption and metabolism in rats; radiation injury to the exteriorized intestine of rats; the pathological effects of radioactive particles deposited in the lungs of mice; factors affecting the uptake of fission products by plants; the genetic effects of $S^{35} \beta$ particles in the growth media of yeast; the radiobiological monitoring of the Columbia River; the monitoring of reactor effluent water; development of a tentative procedure for the determination of the rare earth group in reactor effluent water; investigations in the development of chemical dosimeters; meteorological studies on particle diffusion and transport in which fluorescent particles were used as tracers to study the growth of a smoke plume in both the vertical and horizontal directions; development of an instrument employing a scintillation counter to measure Pu concentration in wounds of the hands; and the development of instruments for neutron dosimetry and an α air monitor.

REFERENCES

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HW-55586

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE
FIELD OF RADIOLOGICAL SCIENCES. Quarterly
Progress Report for January-March 1958. J. W.
Healy, ed. Apr. 3, 1958. Decl. Oct. 13, 1958. 47p.
Contract W-31-109-Eng-52. \$7.80(ph OTS); \$3.30
(mf OTS).

The toxicity of reactor effluent under changing concentrations which may occur in the Columbia River as a result of fluctuating river flows when power is produced by Priest Rapids Dam was re-evaluated with young salmon. Data are tabulated. The effect of radioactive elements on aquatic organisms was studied on rainbow trout which were fed P^{32} for 24 weeks. Progress is reported on studies of the effects of small, chronic doses of I^{131} in sheep and swine; strontium metabolism in lambs and miniature pigs using Sr^{89} and Sr^{90} as tracers; the tissue distribution of plutonium in miniature pigs and rats; the effect of dietary calcium level and duration of exposure period on the deposition and retention of Sr^{90} and Ca^{45} in rats; the tissue distribution of Zn^{65} in rats; the histopathological effects of radiation on the intestinal tract; the effect of x irradiation on the DNA content and DNA synthesis in the intestinal tract; the tissue distribution and solubility in body fluids of inhaled radioactive particles; the uptake of radioactive substances by plants; the uptake of Cs^{137} and Zn^{65} by aquatic plants and animals; field studies employing fluorescent pigment tracers on the airborne concentrations of materials emanating from the reactor areas; and the development of an empirical system for forecasting probable trajectories of particles in the atmosphere. Literature surveys were made on measurements and data on ranges and stopping powers of charged particles. The testing of a slow neutron ionization chamber in a moderated neutron detector indicates the possibility of providing fixed monitors to integrate the fast neutron dose at working locations. Operation of the rock-shield body monitor is reported. Studies of the geology, hydrology, and soil characteristics of the region were continued with refinement of the techniques involved so that the parameters involved in ground waste disposal can be better defined. (For preceding period see HW-54938.)

39

HW-56928

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE
FIELD OF RADIOLOGICAL SCIENCES QUARTERLY
PROGRESS REPORT [FOR] APRIL-JUNE 1958. J. W.
Healy, ed. July 28, 1958. 41p. Contract W-31-109-
Eng-52. \$1.25(OTS).

A test was made to determine the effect of changing concentrations of reactor effluent in the Columbia River on young Chinook salmon. Data are tabulated. Progress is reported in the following studies: the effects of chronic ingestion of low-level iodine-131 in sheep and swine; tracer studies on strontium metabolism in swine and rats; the effects of various treatments on the absorption and tissue distribution of plutonium; the effects of dietary calcium levels on strontium-90 bone deposition in rats; and the absorption and metabolism of fission products in rats. The fate and toxicity of inhaled radioactive materials were studied in mice. Data are included for particles containing plutonium-239, ruthenium-106, iodine-131, and strontium-90. Increased

genetic effects were observed from phosphorus-32 metabolized by yeast cells when compared with the effects from phosphorus-32 in the medium surrounding the cells. Data are included from studies on the effects of soil conditions on the uptake of strontium-90 by plants. Results are reported from routine radiobiological studies and environs monitoring activities. A study was made of the formation of radioisotopes in reactor effluent water, and an analysis was made of reactor film material removed from two process tubes by purging with a chemical cleaner. Fluorescein dye was used in studies of ground water flow. Laboratory investigations were conducted to obtain data for waste disposal studies. (For preceding period see HW-55586.)

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HW-57908

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE
FIELD OF RADIOLOGICAL SCIENCES. Quarterly
Progress Report [for] July-September 1958. J. W.
Healy, ed. Oct. 15, 1958. 36p. Contract W-31-109-
Eng-52. \$1.25(OTS).

No definite pathological damage was observed in fish fed 0.006 μ c and 0.06 μ c phosphorus-32 per gram body weight per day, although a reduction in growth rate occurred at the 0.06 μ c level. Pathological damage was evident at the lethal feeding level of 0.6 μ c. Damage to the gastrointestinal tract involved all segments with equal frequency and ranged from mild damage to the epithelium at three weeks to severe damage and breakdown of the mucosa after 15 weeks. Pathological changes were also observed in the kidneys, liver, and spleen. Progress is reported in the following studies: the effects of chronic ingestion of low levels of iodine-131 in sheep and swine; the tissue distribution of single oral doses of strontium-90 in swine; blood volume determinations in swine of various ages and weights; the retention of a single dose of strontium-90 and calcium-45 in mature rats as influenced by the total calcium level of the diet; the tissue distribution of zinc-65, tungsten-185, and phosphorus-32 in rats, with emphasis on the relatively high radiation dose from phosphorus-32 in the ovary when compared to bone; the pulmonary deposition and development of lung tumors in mice following intratracheal administration of ruthenium-106; the effectiveness of various aerosol treatments in removing Ru^{106} O_2 particles from the pulmonary tract; the effect of variation in the strontium-calcium ratio on uptake of strontium-90 and calcium-45 by plants; the uptake of zinc-65 by plants irrigated with undiluted reactor effluent; radiobiological monitoring of the Columbia River and environs; the measurement of the vertical profiles and of the integrated cross-wind concentrations of airborne tracer materials used in diffusion and transport studies; routine monitoring activities; detailed duplicate activation analyses of the various materials which could contribute to the radioisotope level in the reactor effluent water; a test of the ability of a column of aluminum turnings to remove radioisotopes from reactor effluent; determinations of the radiation-protective ability of various anionic groups in aqueous solutions; a survey of surface features of the basalt bedrock beneath the Hanford waste disposal area; ground waste disposal studies; and fission product volatility studies. (For preceding period see HW-56928.)

REFERENCES

41 HW-58833

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE
FIELD OF RADIOLOGICAL SCIENCES. Quarterly
Progress Report [for] October–December 1958. J. W.
Healy, ed. Jan. 12, 1959. 38p. Contract W-31-109-
Eng-52. \$1.25(OTS).

Data are tabulated from studies on the metabolism and toxicity of fission products in rainbow trout and other fish. The effects of added dietary calcium on the uptake, retention, and transfer of strontium-90 and calcium-45 were studied in ewes, lambs, swine, and rats. Preliminary data are reported. Initial data are included from a study of the additive effects of external radiation and plutonium deposited in the body. The therapeutic effectiveness of DTPA was found to be superior to other chelating agents tested for the removal of plutonium in rats. Additional data are presented on the effect of age on zinc-65 absorption in rats. Gastrointestinal radiation injury is described in rats maintained on drinking water containing various doses of yttrium-90. Erioglaucine showed a protective effect against radiation injuries in mice. Progress is reported in studies on the following: biological effectiveness of beta particles from phosphorus-32, sulfur-35, and tritium on plants; the metabolism of fission products by plants; the transfer of fission products in an aquatic environment; studies on the concentration of beta emitters in small fish; tracer studies on the dispersion of airborne materials from stack effluent; the improvement of instruments for radiation dosimetry; the completion and testing of a body monitor for the direct measurement of radioisotopes in the bodies of people; an investigation of the contribution of reactor effluent to radioactivity of Columbia River water; the development of analytical procedures for the determination of antimony-122, antimony-124, iron-59, scandium-46, and scandium-47 in reactor effluent water or irradiated reactor cooling system materials; the determination of zirconium-95 and niobium-95 in mixtures of the two isotopes using a liquid scintillation coincidence spectrometer; the development of colorimetric dosimeter solutions; the drilling and closed-circuit television examination of test wells; research in soil physics and soil chemistry; and ground waste investigations. (For preceding period see HW-57908.)

42 HW-60137

General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE
FIELD OF RADIOLOGICAL SCIENCES. Quarterly
Progress Report [for] January–March 1959. J. W.
Healy, ed. Apr. 23, 1959. 36p. Contract W-31-109-
Eng-52. \$1.25(OTS).

Comparative studies of calcium and strontium metabolism and the influence of calcium content of the diet on strontium uptake indicate a lack of similarity in behavior between these two ions. Progress is reported in the following studies: the effect of strontium-90 and yttrium-90 on rainbow trout; the effects of the chronic ingestion of small doses of iodine-131 in sheep; the gastrointestinal absorption of orally administered strontium-90 in miniature swine; the effectiveness of various treatments in the therapy of radioinduced skin lesions; the absorption and metabolism of plutonium and the effects of DTPA on the deposition of plutonium in bone; the effects of the chronic ingestion of stron-

tium-90 and calcium-45 in young rats; the effects of age on the absorption and retention of zinc-65 in rats; the long term effects of ingested yttrium-90 on the intestine; the radioprotective effects of erioglaucine in rats; the presence of lymphosarcomas in the intestinal mesentery of mice exposed to $\text{Pu}^{239}\text{O}_2$ atmosphere; the deposition and translocation of Pu^{239} following inhalation of $\text{Pu}^{239}\text{O}_2$ in dogs; the distribution of iodine-131 in sheep following exposure to iodine-131 vapor and silver iodide-iodine-131 aerosol; the radiosensitivity of yeast cells; the uptake of cesium-137 and strontium-90 by bean plants; a comparison of the quantities of the fission products, zirconium-niobium-95, cesium-137, cerium-141, and cesium-praseodymium-144 in plants and animals collected from various habitats with the amount of rainfall; the radiobiological monitoring of the Columbia River; modifications in personnel monitoring instruments; the completion of a whole-body monitor; the installation and testing of radiotelemetry equipment; investigations relative to detection techniques; a study of the process of adsorption and subsequent erosion of isotopes in reactor process tube film; geological and hydrological studies of the Hanford area of interest in problems of waste disposal; investigations on the immobilization of radioisotopes in waste solutions; the effectiveness of commercial anion exchange resins for removing plutonium from waste solutions; a review and analysis of information on fuel element rupture debris released to the Columbia River; and the release of fission products from heated low-level irradiated unclad uranium. (For preceding period see HW-58833.)

43

ATOMIC RADIATION DANGERS AND WHAT THEY
MEAN TO YOU. H. W. Heckstall-Smith. London,
J. M. Dent & Sons, Ltd., 1958. 112p.

The hazards associated with natural radiation, industrial, medical, and research radiation, atomic and thermonuclear weapon explosions, and atomic plant operations are discussed.

44

(NP-11928) HUMAN INTERNAL RADIOISOTOPE DOSIMETRY, INSTRUMENTATION, PROPHYLAXIS AND THERAPY. Annual Progress Report, July 1, 1961–June 30, 1962. Robert M. Heyssel and George R. Meneely (Vanderbilt Univ., Nashville. School of Medicine). June 30, 1962. Contract DA-49-007-MD-995. 84p.

Preliminary experiments with Zr^{95} – Nb^{95} and Ba^{140} – La^{140} were used to determine the body burden and organ concentrations in rats. The biological half time for Ba^{140} – La^{140} was about seven days. Most of the remaining nuclide was in the bone. Equations were derived to determine the amount of Ba^{140} – La^{140} , Zr^{95} – Nb^{95} , and Ru^{103} – Rh^{103m} in the human body using data obtained by whole-body counting techniques. Computer programs to process the data and to provide rapid determination of counting rates under photopeaks of any isotope counted in the steel room were developed. Concentration of intraperitoneally administered Cs^{137} in rats was greatest in gastrocnemius muscle with decreasing concentrations in ilium, kidney, stomach, liver, heart, spleen, lung, and brain. In the Radioactivity Survey Cs^{137} burdens in 659 persons were significantly higher in the white race than in the Negro and in males than in females. Other studies included weekly measurements of Cs^{137} burdens in ten normal subjects, data analysis of potassium content in people, total body potassium during therapy in essential hypertension, isotope labeled Vitamin B₁₂ in normal and abnormal subjects, wholebody counting techniques

REFERENCES

for the determination of absolute absorption of iron, ^{131}I accumulation in human thyroid tissue during 1962 U.S.A. nuclear weapon testing, and C^{14} 5-hydroxytryptamine platelet survival.

45

BIBLIOGRAPHY ON THE BIOLOGICAL EFFECTS OF THORIUM. E. Hutchinson. (U. S. Atomic Energy Comm.) Jan. 18, 1960. (UR-563) (p.1-47)

46

(STI/DOC/10/4) IAEA RESEARCH CONTRACTS FIRST ANNUAL REPORT. Technical Reports Series No. 4. (International Atomic Energy Agency, Vienna). 1961. 31p.

Summaries are included of research contracts which expired prior to Dec. 31, 1960. The contracts were concerned with investigations of: electrophysiological responses of biological systems in nerve cells to irradiation with small doses of ionizing radiations; the mode of the protective action of certain sulfhydryl compounds against radiation effects on the synthesis of deoxyribonucleic acid, using tritium-labeled thymidine; development of a bubble chamber method of monitoring and dosimetry for low fast neutron fluxes; effects of incorporated radioisotopes on the stability of genetic materials; interrelation of root and leaf absorption of radioisotopes in herbaceous plants; uptake of radioactive wastes by lowland rice from soils contaminated by irrigation water, and decontamination of the rice; and comparison between mutation rates induced by acute and chronic gamma irradiations.

47

ACRH-7
Argonne Cancer Research Hospital, Chicago.
SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. Mar. 1957. 88p. Contract AT-(11-1)-69. \$0.50(OTS).

Progress is reported in studies on the biological effects of deuterium in mice; the effects of injected cell suspensions on the development of cataracts in irradiated mice; tracer studies on the metabolism of progesterone during pregnancy; tracer studies on cholesterol metabolism and steroid synthesis; development of a test for the determination of taurine in urine; the validity of using tritium self-radiation labeling in biochemical tracer studies; the preparation of labeled digitoxin by the tritium self-radiation method; studies on the tissue distribution, excretion, and placental transfer of radioactive digitoxin in human beings; and the feasibility of counting double-labeled compounds of tritium and C^{14} using a liquid scintillation counter with a two channel pulse height analyzer. Results are included from a theoretical study of the effect of variables on the shape of the electron energy spectrum and beam current of the ACRH linear electron accelerator. (For preceding period see ACRH-6.)

48

ISOTOPIC TRACERS IN BIOLOGY. AN INTRODUCTION TO TRACER METHODOLOGY. Martin D. Kamen. New York, Academic Press Inc., 1957. 485p.

Applications of stable and radioactive isotopes in biological research are reviewed. Related chemical, physical, and biochemical applications and methodology are discussed. Numerous concrete examples illustrating work with tracers are included. 124 references.

49

A/CONF.15/P/860
Argonne National Lab., Lemont, Ill.; Argonne Cancer Research Hospital, Chicago; Suburban Cook County Tuberculosis Hospital-Sanitarium, Hinsdale, Ill.; and Chicago. Univ.

THE BIOLOGY OF DEUTERIUM. J. J. Katz, H. L. Crespi, A. J. Finkel, R. J. Hasterlik, J. F. Thomson, W. Lester, Jr., W. Chorney, N. Scully, R. L. Shaffer, and Sung Huang Sun. 17p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

That replacement of hydrogen by deuterium has far-reaching consequences for living systems has long been noted, but the full scope and nature of these effects still remain largely unexplored. Early work was greatly hampered by the difficulties of obtaining deuterium but the development of a vast nuclear energy technology has made deuterium available on a large scale. It has now become opportune to undertake comprehensive studies on the biology of deuterium, and this paper reports work undertaken on algae, fungi, bacteria, and mammals. Mice will tolerate up to about 40 per cent D_2O in the drinking water for at least four months; during this period the body water reaches a stable value of about 30 per cent heavy water. When deuteration is continued for long periods, deuterium is incorporated into various tissues and organs to the amount of from 40 to 50 per cent of the deuterium in the body fluids. Mice have been maintained in a deuterated state, up to 25 atom per cent, for as long as 12 months without obvious effects, although there are some indications that fertility is adversely affected. The basis of the biological effects of deuteration is the kinetic isotope effect. In general, bonds to deuterium react less readily than bonds to hydrogen; in consequence, reaction rates are decreased, and a depression in tissue metabolism should result. At concentrations above 30 atom per cent deuterium mice and rats show weakness, neuromuscular hyperexcitability, bradycardia, and eventually, stupor and death. Since neoplastic cells metabolize rapidly, presumably these should be particularly sensitive to the effects of deuteration. Deuteration of host mice resulted in reduced growth rates of injected Krebs-2 ascites tumors and of inoculated P-1534 lymphatic leukemia. The general effects of deuterium on growth have been studied in algae and fungi. Two species of algae, *Chlorella vulgaris* and *Scenedesmus obliquus*, have been successfully cultured in nutrient media containing 99.6 per cent D_2O . Growth rates are inhibited, but algae have been harvested that yield water of combustion containing more than 90 atom per cent deuterium. The morphology, pigmentation and granulation of the algae were altered by deuteration. The fungi *Penicillium notatum* and *Aspergillus fonsecaeus* have been grown in media containing various concentrations of D_2O up to 99.6 per cent, and here, too, morphology, sporulation, pigment production, and growth rate were all affected by deuteration. The results obtained with algae clearly indicate the feasibility of producing fully deuterated compounds of biological significance by biosynthetic procedures. Bacterial studies on Group C hemolytic streptococci, Type I pneumococci, *Mycobacterium tuberculosis* and *M. phlei*, and *Escherichia coli* showed that the growth rates were diminished with elevation of the D_2O concentration above 50 per cent and that cessation of growth uniformly occurred at D_2O levels greater than 90 per cent.

REFERENCES

Deuterium may also be utilized in the study of metabolism by the administration of deuterated essential metabolites. Experiments are described wherein fungi have been grown on glucose in which the hydrogen on carbon-1 (D-glucose-d₁) has been completely replaced by deuterium.

50 CHEMICAL AND BIOLOGICAL STUDIES WITH DEUTERIUM. Joseph J. Katz. *Am. Scientist*, 48: 544-80 (Dec. 1960).

A basic flowsheet is presented for the production of deuterium oxide by the H₂O/H₂S dual-temperature exchange process. Cost factors are discussed. The physical properties of H₂O and D₂O are compared. It is shown that the substitution of hydrogen by deuterium in water gives rise to marked changes in physical properties. Applications of deuterium in chemical and biological studies are reviewed. Topics discussed include kinetic isotope effects of deuterium compounds; reaction rate phenomena which are known to exhibit isotope effects; the deuterium isotope effect in living systems; the growth of algae in heavy water; a comparison of ordinary and deuterated algae; the isolation of deuterated chloroplast pigments and other fully deuterated compounds from algae; photosynthesis in deuterated green algae; deuterium isotope effects on mammals; deuterium isotope effects on tumor growth; and the preparation of compounds in which hydrogen is replaced by deuterium.

51 A/CONF.15/P/1029

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOSTRONTIUM-CALCIUM RELATIONS IN PLANTS AND ANIMALS. H. A. Kornberg. 12p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

In laboratory experiments the uptake in plants of Strontium-90 was measured as a function of calcium in the root environment. In general, the uptake of Sr⁹⁰ was not found to decrease as a result of the calcium present. When rats were intraperitoneally injected or fed in single doses mixtures of Sr⁹⁰ and calcium, the deposition of Sr⁹⁰ on the skeleton was not found to be affected by the presence of calcium in the administered dose. Groups of rats which were maintained on diets containing several levels of calcium along with Ca⁴⁵ and Sr⁹⁰ were found to deposit less Sr⁹⁰ and Ca⁴⁵ on their skeletons as the calcium in the diet was increased. However, the decrease of Sr⁹⁰ deposition with increase in dietary calcium was less than that which would have occurred if the strontium had deposited in inverse proportion to the calcium in the diet. The data also showed that beyond 0.5% of dietary calcium there was no further decrease of Sr⁹⁰ deposition with increase of calcium. Similar observations were made with lambs that were fed Sr⁹⁰ and calcium gluconate in milk. The gluconate ion was found to account for a significant amount of the decreased Sr⁹⁰ deposition observed. These experimental observations point to the need for measuring Sr⁹⁰ contamination in absolute units and tend to support theoretical considerations of the effect of isotopic dilution. The movement and deposition of substances can occur by only four processes: flow, diffusion, adsorption, and chemical reaction. Each of these processes may be separately considered to determine the effect of the addition of one isotope on the movement or deposition of another isotope. For the processes of flow and simple diffusion, isotopic dilution is without effect. For the processes of adsorption and chemical

reaction, isotopic dilution will be effective only under the condition that some acceptor material upon which the element deposits approaches saturation. Even under this condition the effect of one isotope on another need not be a linear inverse relationship. Experimental data involving radioactive and non-radioactive isotopes other than radiostrontium and calcium which also support these hypotheses are presented.

52

DEUTERIUM IN BIOLOGY. D. Kritchevsky. *Ann. N. Y. Acad. Sci.* 84, 575(1960) Nov.

53

DEUTERIUM ISOTOPE EFFECTS IN CHEMISTRY AND BIOLOGY. David Kritchevsky, ed. *Ann. N. Y. Acad. Sci.*, 84: 573-781(Nov. 25, 1960).

Twenty-one papers are presented. One paper not abstracted includes a brief discussion on deuterium in biology. Nine papers were previously abstracted in *NSA*. Separate abstracts have been prepared for the remaining eleven papers.

54

THE APPLICATION OF RADIOISOTOPES IN BIOLOGY. A. M. Kuzin (International Atomic Energy Agency, Vienna). Review Series, Developments in the Peaceful Applications of Nuclear Energy. No. 7. 63p. (1960). (STI/PUB/15/7). (In Russian and English)

This survey of the ways in which radioisotopes are used in biology will give the reader an idea of the most promising trends in the use of this new method of investigation in the various branches of biology. It is based on work published in 1959 and illustrates the application of radioactive tracers to biochemistry, plant and animal physiology, microbiology and immunology, histomorphological research, hydrobiology, entomology, ichthyology, genetics, and other biological disciplines, and gives a complete picture of the use of isotopes in biology. A bibliography of 570 references is attached, covering articles, books, and monographs in which the reader can find information about the ways in which radioactive isotopes are used in biological research and for practical economic purposes.

55

BIOLOGICAL STUDIES ON CALCIUM, STRONTIUM, LANTHANUM, AND YTTRIUM. D. Laszlo. (Montefiore Hosp., New York, N.Y.). *Proc. Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1955* 10, 62-7(Pub. 1956). CA-52-5613c.

56

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. PART I. Johannes Meissner. *Kerntechnik* 2, 91-5(1960) Mar. (In German)

A survey of the application of radioisotopes in biology and medicine considers first the indicator method and then irradiation techniques. In this first part, as an example, some biological questions were discussed which could be examined in detail by the application of isotopic tracers. Distribution studies in an organism and metabolism studies were treated in this connection. (tr-auth)

57

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. [PART] II. Johannes Meissner (Forschungsinstitut, Borstel, Ger.). *Kerntechnik* 2, 126-31(1960) Apr. (In German)

REFERENCES

The properties of radioactives which affect the planning, carrying out, and evaluation of tracer studies are reported. In addition to the biochemical reactions which must be followed with the tracers, the selection must be determined from physical factors as half life, type and energy of radiation, specific activity, carrier, and isotope effect. The effect of these factors on the measurement techniques was considered. Regulations for the tracer dose and the measurement magnitudes are given. The applicability of stable isotopes as tracers is discussed.

58

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. [PART] III. Johannes Meissner (Forschungsinstitut, Borstel, Ger.). Kerntechnik 2, 163-6(1960) May. (In German)

The application of radioisotopes in radiotherapy is discussed. The methodic possibilities given are explained in comparison with x-ray therapy. The units for radiation dose and absorbed dose are introduced, and the conclusions for the applicability of various radiation types are described. The application methods offered for therapeutics are outlined and illustrated by an example. The application of sealed preparations which are used in body cavities and tissues and open preparations, especially in the selective irradiation method, is discussed.

59

RADIOISOTOPES IN ANIMAL AND PLANT BIOLOGY. Orsini F. F. Nicola. Fac. agron. y vet., Univ. Buenos Aires, Escuela agron., Bull. No. 35, 98p. (1958). (In Spanish)

Chapters are included on the fundamentals of nucleonics and radiation, radiation effects and isotope applications, radioisotopes in animal physiology and veterinary medicine, and radioisotopes in the plant kingdom.

60 ORINS-34

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn. OAK RIDGE INSTITUTE OF NUCLEAR STUDIES MEDICAL DIVISION REPORT FOR 1959. 87p. Contract AT-40-1-GEN-33. OTS.

Studies associated with whole-body irradiation followed by attempts at bone-marrow grafts in acute leukemia patients were continued. Data were compared with results reported by other workers. Results are reported from studies on the effects of both whole-body and local-port irradiation on various hematological diseases, other clinical syndromes, and normal hematopoietic tissues. It was demonstrated that large doses of whole-body irradiation alone can produce remissions in leukemia. Results are reported on a group of patients who received autologous bone marrow grafts after a single large dose of nitrogen mustard. Clinical results are reported on a group of eleven patients with acute or subacute leukemia given a single large dose of whole-body irradiation, varying from 200 r to more than 900 r, followed by intravenously administered bone marrow from homologous donors cross matched for the usual major blood types. A summary is included of current impressions of the treatment of leukemia by irradiation and marrow grafting. Pathological changes following whole-body irradiation are discussed. Results are reported from clinical studies on 8 men exposed to whole-body radiation 9 months previously during the Y-12 accident. A comparison is made in data on the Y-12 patients and data on the Yugoslavian accident victims. Procedures

for the recovery of amino acids from solutions are discussed and data are tabulated on daily variation in levels of urinary amino acids, and the effects of whole-body irradiation or nitrogen mustard on urinary excretion of amino acids. Research with internal isotopes was continued and progress is reported in the development of scanning equipment and in interpretation of results. Teletherapy treatments were given to 64 patients suffering from lymphomas of several types. Summaries are included of experimental work on the properties and localization by linear scanning of calcium-47 in rats; the distribution of radioactive colloidal yttrium in rats; selective irradiation by the intralymphatic injection of radioactive preparations; metabolism of rare earths; and liver-liquid response to radiocerium. The design and calibration are described of a whole-body irradiator employing 8 cesium-137 teletherapy machines. New designs and design modifications are described for equipment for scanning and radiation therapy. A training program is outlined. A list of publications during the period is included.

61 HW-41026(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOLOGICAL SCIENCES DEPARTMENT RESEARCH AND DEVELOPMENT ACTIVITIES QUARTERLY PROGRESS REPORT [FOR] OCTOBER - DECEMBER 1955. H. M. Parker. Jan. 11, 1956. Decl. with deletions Feb. 26, 1957. 33p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the toxic effects of continuous low-level exposure to I^{131} in pigs; Pu metabolism in miniature pigs and rats; the tissue distribution and retention of Ru^{106} and Cs in rats and mice; the radiosensitivity of the intestine of rats; the pulmonary absorption of radioactive particles and the pathological effects of such particles in the lungs of mice; the uptake of I^{131} and other fission products from the soil and from air by plants; determinations of the relative biological effectiveness for yeast cells of Po^{210} α particles and P^{32} β particles; the development of chemical and radiological monitoring methods for studies of radioactive contamination, temperature, and concentration of non-radioactive toxic materials in waste streams, soil, ground water, and air; the separation of fission products from waste streams; and improvements in instruments for monitoring and low-level radiation counting. The status of the research programs of the department is reviewed. (For preceding period see HW-39624.)

62

PROBLEMS OF RADIOBIOLOGY. II. DISTRIBUTION AND TOXICOLOGY OF HEAVY ELEMENTS: URANIUM AND THORIUM. Ferdinando Passalacqua. (Univ. Freiburg, Ger.). Ricerca sci. 27, 1531-8(1957). CA-53: 2299h.

63

IMPORTANCE OF RADIOISOTOPES IN VETERINARY MEDICINE. M. V. Plakhotin and A. D. Belov. (Vet. Acad., Moscow). Veterinariya 35, No. 8, 61-4(1958). CA-53:3428e.

64

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 23.

REFERENCES

EXPERIENCE IN RADIOLOGICAL PROTECTION. Geneva, United Nations, 1958. 461p. \$14.50.

New developments in radiation protection and recovery are reviewed. Topics discussed include developments in experimental therapy, methods for the assessment of biological contamination, radiation in the natural environment, experience in radiological protection and the control of radiation hazards, the evaluation of radiation hazards, the development of instruments for the detection of contamination, and the treatment of internal contamination.

65 UCLA-195 (Del.)

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1952. Apr. 1, 1952. Decl. with deletions Mar. 7, 1957. 71p. Contract AT-04-1-GEN-12. \$12.30(ph OTS); \$4.50(mf OTS).

Progress is reported in medical research studies.

66 UCLA-379

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1956. Oct. 1, 1956. Decl. Mar. 6, 1957. 148p. Contract AT-04-1-GEN-12. \$22.80(ph OTS); \$7.20(mf OTS).

Progress is reported in the following studies: the synthesis and analysis of unsaturated fatty acids; the effects of whole-body x irradiation on the blood plasma Fe level in rabbits; an evaluation of the effect of quinoxaline 1:4-di-N-oxide on the survival time of irradiated mice; the effect of acute and chronic intravenous infusions of Dextran in irradiated rabbits; investigations of tracer techniques in liver function tests, kidney function tests, and thyroid function tests; the effect of pre-treatment with sodium salicylate on radiation mortality in mice; the skeletal deposition of Y^{91} , Ca^{45} , and S^{35} in rats following bone fracture; factors affecting the gastrointestinal absorption of Sr^{90} ; the causative organisms in mouse bacteremias induced by x irradiation; the radiosensitivity of tobacco mosaic virus; effects of irradiation on lipoproteins in embryonic serum; routine monitoring and waste disposal activities; the analysis of human bone samples for Sr content; improvements in the performance of electron microscopes; the performance of chemical radiation detectors when used as dosimeters; factors affecting the uptake of fission products by plants and animals; the accumulation and persistence of radioactive fall-out material in samples of soils, vegetation, animal tissues, and milk collected at various sites and at various times; and a review of soil sampling and processing procedures for radiometric analysis. (For preceding period see UCLA-371.)

67 UCLA-386

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1956. Jan. 1, 1957. Decl. Mar. 14, 1957. 124p. Contract AT-04-1-GEN-12. \$18.30(ph OTS); \$6.00(mf OTS).

Progress is reported in the following studies: the induction of leukemia in mice following injection of a cell-free extract; biochemical studies of leukemic cells; the isolation of ribonucleic acid from yeast; methods for the complete analysis of the fatty acids of tissues or organs; the synthesis and analysis of unsaturated fatty acids; the effects of total-body irradiation on the 5-hydroxytryptamine level in

rats; the effect of irradiation on the blood serum Cu and Mg level in burros; the tissue distribution of Dextran in irradiated rabbits; the development of tracer methods for testing liver function, kidney function, thyroid function, and general metabolism; a comparison of physical, chemical, and biological methods for x radiation dosimetry; mechanisms of bone deposition of Y^{91} , Ca^{45} , and S^{35} , and Sr^{90} in rats and rabbits; effects of irradiation on porphyrin compounds; the production and isolation of an antibiotic agent; studies on the late effects of x irradiation on rats; routine health physics activities; the development of chemical radiation dosimeters for medical use; the development of a vacuum tube model of a time-of-arrival-of-fall-out-indicator; the metabolism of Ca and Sr in vertebrates; the redistribution of Pu in soil of a previously contaminated area; and an evaluation of sampling methods for the determination of α air concentration. (For preceding period see UCLA-379.)

68 HW-62638

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY PROGRESS REPORT ON RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, JULY-SEPTEMBER 1959. Nov. 5, 1959. 38p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the effect of fission products in reactor effluent on young rainbow trout; the pathological effects of iodine-131 in laboratory animals; determinations of the body burdens and effects on gonads of cesium-137 and zinc-65; the pathological effects of plutonium-239; the effects of age and DTPA therapy on plutonium toxicity in rats; the uptake of fission products by plants; monitoring of beta radioactivity in Columbia River fish; studies on meteorological dispersion using fluorescent pigment tracer particles; the development of radiation monitoring instruments; measurements of radioactivity in reactor effluent; ground waste investigations; environmental monitoring activities; and experiments on the oxidation of uranium and volatilization of fission products. One hundred thirty-six people were measured at the Shielded Personnel Monitoring Station. Results are discussed. (For preceding period see HW-61247.)

69 HW-63643

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY PROGRESS REPORT ON RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, OCTOBER-DECEMBER, 1959. Jan. 25, 1960. 37p. Contract AT(45-1)-1350. OTS.

Passage through a bed of aluminum turnings lowered the concentration of radiophosphorus in reactor effluent water. No difference in the mortality rate was observed in experimental and control groups of rainbow trout given intramuscular injections of strontium-90-yttrium-90, but gastrointestinal damage resulted when trout were fed the same levels of strontium-90-yttrium-90. Progress is reported in studies on the transfer of strontium-85 across gill membranes in fish; the effects of deposited phosphorus-32 on survival and reproduction in fish; the biological effects of the chronic ingestion of small amounts of iodine-131 in swine; the effects of the chronic ingestion of small amounts of strontium-90 by swine on the blood picture of the offspring; the distribution of phosphorus-32 in the tissues of mice as demonstrated by counting with the whole-body mouse counter; the absorption and metabolism of plutonium in rats and swine in which a defi-

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nite relationship was shown between body burden of plutonium and survival time following irradiation; the metabolism of strontium-90 and calcium-45 in rats; the pathology of gastrointestinal radiation injury and the use of polyvinylpyrrolidone labeled with iodine-131 as a diagnostic aid in the estimation of intestinal radiation injury; the evaluation of hazards from inhaled plutonium oxide; the effects of x radiation on the permeability of yeast cells; the radiobiological monitoring of the Columbia River and environs; and the uptake of strontium-90 and cesium-137 by plants from contaminated soils. Phosphorescent zinc sulfide was used as a tracer in studies on the effects of meteorological conditions on the diffusion of particulate matter. A new system was developed for reading the amount of zinc sulfide. An analysis was completed on the data from 169 subjects given routine examinations in the Shielded Personnel Monitoring Station. Results for potassium and cesium were similar to those obtained with other whole-body counters. Investigations were made of the quantities of zinc-65 in human subjects, water, and foodstuffs and the route of transfer of zinc-65 to humans. It was found that zinc-65 in oysters and other sea food may be responsible for occasional high body burdens found in people. Investigations of techniques and experimental instrument development work were continued during the period. Problems involved in neutron dosimetry and field and personnel monitoring were investigated. Studies were continued on the deposition of particles on duct walls. Results indicate the importance of the velocity of air through the duct and of the particle diameter. (For preceding period see HW-62638.)

70 JPRS(NY)-899

RADIOBIOLOGY IN THE USSR. Translation of Abstracts of Articles from Selected Soviet Periodicals. 19p. OTS.

Abstracts are presented of articles from selected Soviet periodicals dealing with applications of radiation and radioisotopes in biology and medicine. Topics covered include hematological research, the effect of hypothermy on the living organism, a tracer study of the role of chemosynthesis in the production of silt deposits and bacterial slimes in reservoirs, the metabolism of strontium-89 in rats, and various other tracer studies on metabolism in rats.

71 KAPL-997

Knolls Atomic Power Lab., Schenectady, N. Y. RADIOLOGICAL DEVELOPMENT ACTIVITIES IN THE HEALTH PHYSICS UNIT. Semiannual Progress Report [for] January-June 1953. Changed from OFFICIAL USE ONLY June 3, 1957. 33p. Contract W-31-109-Eng-52. \$6.30(ph OTS); \$3.00(mf OTS).

The calibration of the constant air monitor used to detect Kr^{85} emanating from the Separations Process Operations was completed. An average detection efficiency of 1.1% and an absorption factor of 0.7 were determined from three series of analyses. The efficiency of Special Materials Shop air-cleaning unit in the collection of submicronic particles under specific operating conditions is reported. Recommendations to increase the efficiency are made. The collection efficiency, as a function of particles size, for air-cleaning and air-sampling filter media is reported for a face-velocity range of 0.5 to 100 cm/sec. The minimum collection efficiencies for the particle size and face-velocity ranges were investigated. The average absorptions of alpha and beta activity in the Hollingsworth and Vose-70 filter media for a series of analyses were 63 and 24%, respectively. Liquid waste studies during the period in-

clude the investigation and recommendation of a proportional sampler for combined sewer effluents and adsorption studies of fission-product activity on the Mohawk River sediment. A discussion of the metering and sampling system for the liquid waste discharged into the Mohawk River is included in this report. The adsorption of fission-product activity on Mohawk River sediment with respect to contact time, laundry detergents, dissolved solids, and the quantity of river sediment was investigated and the data are tabulated. A vegetation analysis for radioruthenium was investigated, and a tentative calculation of the maximum permissible concentrations of activity in vegetation was made. A preliminary substitute for the Sigma Pile was constructed to permit routine and low dose-rate range thermal and slow neutron calibrations. Formulas to determine the integrated dose due to the rain-out and fall-out of activity from a fission-product cloud have been developed and are discussed.

72 (ANL-6297) RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT, JULY THROUGH DECEMBER 1960. (Argonne National Lab., Ill.), Feb. 1961. Contract W-31-109-eng-38. 133p.

Data are presented from studies on the total Ra^{226} content, radon retention, and activity of hotspots in human bones approximately 30 yr post-administration of Ra. Preliminary results are reported from a study of the incidence of bone tumors following injection of Pu^{239} , Ra^{226} , Sr^{90} , or Ca^{45} in mice. Calculations were made of the radiation dose from hotspots formed in bone by these radioisotopes. The γ spectra of 20 subjects who contained known quantities of K^{42} were obtained with several different sized NaI(Tl) crystals located at various points around the body. These spectra were analyzed to determine the variations in counting rates that resulted with each patient-crystal arrangement. The total-body γ spectra of 12 unexposed employees were measured with the human spectrometer over a span of 30 mo. Data are tabulated on Co^{137}/K^{40} ratios. The response of a scintillation counter to γ radiation as a function of incidence angle was measured. Studies were made on the refractive index of selected optical media. Improvements were made in the design and in the scintillator solvent for a twin scintillation fast neutron detector. Measurements were made of the skeletal and soft tissue content of Ra in normal humans whose primary source of Ra was food. Calculations of the half lives and distributions of stable Pb and Pb^{210} in the human body are discussed. Meteorological studies reported include a comparison of observed plume rise of stack effluent with values obtained from well-known formulas, towing tank studies of horizontal turbulent air flow, and soil temperature studies.

73 HW-23332

Hanford Works, Richland, Wash. RADIOLOGICAL SCIENCES DEPARTMENT RESEARCH AND DEVELOPMENT ACTIVITIES FOR OCTOBER-DECEMBER 1951. Quarterly Progress Report. Jan. 24, 1952. Decl. Feb. 20, 1957. 30p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Progress is reported on research and development activities in biology and biophysics. Data are included from the radiobiological ecological survey of the Columbia River, a study of the effects of pile effluent water on aquatic organisms, a study of the absorption of Pu from the gastrointestinal tract, Pu toxicology studies, the effect of growth on the deposition of tissue-bound T, pulmonary absorption of T, effects of radiation on plant life and translocation of

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radioelements in plants, the retention of bound T oxide by the bean plant and T fixation by bacteria. The toxicology of ^{131}I was investigated in sheep and some findings are included.

74 ANL-5679

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1956. Feb. 1957. 106p. Contract W-31-109-eng-38. \$0.55(OTS).

Data are presented from the following studies: the radiation chemistry of xylene; fabrication of a teflon container for scintillating solutions; factors affecting the concentration of Rn in the atmosphere; a comparison of experimental results with theoretical computations of γ radiation *in vivo* and activity of excreta on a human accidentally contaminated with $\text{Th}^{227}\text{Cl}_4$ through a puncture wound; operation of a human spectrometer; *in vivo* measurements of the body burden of Sr^{85} , Te^{129} , and Ra^{226} in human subjects; the development of photomultiplier tubes; the preparation and performance of positive ion sources; tracer studies on the bone deposition of Ce and Tm in dogs; development of procedures for the study of β particle activity employing thick bone section autoradiograms; the preparation and physical properties of Ba^{133} ; studies on background counting rate; the drift velocity of electrons in gases; the development of a multiple exposure photographic technique for studying atmospheric diffusion; and an investigation of automatic data processing methods for use with continuously operating meteorological equipment. A list of publications and a summary of staff activities during the period are included. (For preceding period see ANL-5596.)

75 ANL-5755

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT FOR JANUARY THROUGH JUNE 1957. July 1957. 86p. Contract W-31-109-eng-38. \$2.25(OTS).

Progress is reported in the following studies: the autoradiographic mapping of the deposition of Ca^{45} in cortical bone in dogs; measurement of fission-product activity present in soil; factors affecting the performance of ionization chambers; calibration tests on the dibutyl phosphate method of isolating Th^{228} from solutions of ashed bone; microradiographic demonstration of changes in mineral density in dog bones; radiometric determination of radon in bone and in the atmosphere; changes produced in xylene by exposure to massive doses of Co^{60} γ radiation; applications of the human spectrometer in *in vivo* measurements of Cs^{137} build-up in humans; determinations of Cs^{137} atmospheric content as a function of time; development of a tracer method using K^{42} for measurement of exchangeable potassium in humans; determinations of the radium body burdens in former dial painters; and the atmospheric diffusion of stack particles. A meteorological model towing tank is described which was constructed as an alternative to a wind tunnel for model studies of atmospheric turbulent diffusion. Preliminary studies employing the apparatus are described. (For preceding period see ANL-5679.)

76 ANL-5829

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Feb. 1958. 230p. Contract W-31-109-eng-38. \$5.50(OTS).

Progress is reported in the following studies: effects of various doses of gamma radiation on the light ab-

sorbance of aerated and air-free samples of xylene; the design of a light piping system for a scintillation spectrometer; the development of a simple source of monoenergetic fast neutrons and the possibility of using a spherical moderator to produce a roughly monochromatic distribution of neutrons from a source of monochromatic neutrons of a higher energy; calculation of the body retention and elimination of Ra^{228} and Ra^{224} following a single injection of Th^{232} ; the analysis of gamma-ray spectra by the method of least squares; application of a microradiographic technique in determinations of the mineral density of human bones at various ages, and density values for old bone and new growth in bones from man, dogs, mice, cows, rabbits, and rats; the bone deposition of Ca^{45} following injection in dogs; determinations of the natural Ra^{226} content of 200 water samples from Illinois municipal water supplies; attempts to estimate the fraction of the stratospheric Sr^{90} in the total Sr^{90} transported to the ground by rain by observing variations in the relative amounts of Sr^{89} , Sr^{90} , and Ba^{140} in water from a series of rain-falls; the monitoring of the atmosphere for fall-out; design of a transportable gamma-ray spectrometer; soil temperature studies; the operation of an automatic data processing system for use with the soil temperature measurements; measurements of atmospheric radon; wind-tunnel studies on dispersal patterns of stack gases; and application of a meteorological model towing tank for studies of turbulent diffusion in the atmosphere. A list is included of articles published and accepted for publication during the period. (For preceding period see ANL-5755.)

77 ANL-5919

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1958. Sept. 1958. 143p. Contract W-31-109-eng-38. \$2.75(OTS).

Progress is reported in the following studies: factors influencing the dose-effect relationship of absorbance in gamma-irradiated xylene; an examination of computed values of electron drift velocity and energy distribution function in gases; measurements of the natural neutron and gamma-ray dose rates, using a twin liquid scintillation fast neutron spectrometer; the development of a simple source of monoenergetic fast neutrons; calculations of the body burden and dose rate to bones from internally deposited radium-226 and radium-228; calcium-45 tracer studies on the effect of parathyroidectomy on haversian remodeling of bone; calcium-45 tracer studies on the diffusion of calcium in bone crystallites; the effect of oxygen on ion current measurements in argon; development of a method for determining the strontium-90 content of ashed bone by the solvent extraction of its daughter yttrium-90; the determination of actinium-228 as a method for the determination of its parent radium-228 in water samples; calculations of the stratospheric strontium-90 fall-out; measurements of the concentration of radium-226 in Illinois municipal water supplies; an investigation of the source of background counts in $\text{NaI}(\text{Tl})$ crystals; performance data for a 9.5 by 5-inch crystal detector; the effect of meteorological variables upon the vertical and temporal distributions of atmospheric radon; tracer studies of particle diffusion in isothermal and stably stratified water; and atmospheric diffusion studies in which a smoke stack, an aerial camera, a photogrammetric analyzer, and IBM-650 computer were used to determine the ability of

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the lower atmosphere, in various meteorological states, to diffuse materials released into it and to determine the physical processes involved in diffusion. (For preceding period see ANL-5829.)

78 ANL-5967

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMI-ANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. May 1959. 223p. Contract W-31-109-eng-38. \$3.50(OTS).

Progress is reported in the following studies: the decay time of irradiated scintillation solutions; the performance of twin scintillation detectors for measuring neutrons in the presence of gamma radiation; the measurement of cosmic ray neutron background with a twin scintillation fast neutron spectrometer; the diffusion and absorption of gases in plastic-walled ionization chambers; calculations of the drift velocity and the energy distribution of electrons of helium, neon, argon, and nitrogen under the action of a uniform electric field; the development of equipment for tracer studies of atmospheric diffusion; the deposition and retention of isotopes of actinium, radon, radium, and thorium in bone; the effects of age on calcium metabolism in bone; the development of a mathematical theory of the retention of radioactive elements by bone; the development of a reproducible method for directly determining individual alpha activities in mixtures; the design of a flow-gas Geiger counter; a survey of the natural radioactivity of a number of municipal water supplies; measurements of activity in individuals by means of the human spectrometer; measurements of the cesium-137 content of human subjects; measurements of the atmospheric content of cesium-137 as a function of time; a comparison of background radioactivity at the Laboratory and a site approximately 250 feet below grade level; development of a spectrometric method for measurements of radioactivity in soil; the effects of meteorological variables on the distribution of radon in the atmosphere; and studies of atmospheric diffusion. A list of publications during the period is included. (For preceding period see ANL-5919.)

79

Inter-American Nuclear Energy Commission, Washington, D. C. and Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

RADIOISOTOPES AND RADIATION IN THE LIFE SCIENCES. 2ND INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BUENOS AIRES, 1959. 1960. 275p.

Separate abstracts were prepared on 36 papers presented at this symposium.

80 HW-61247

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] April-June 1959. July 20, 1959. 42p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the toxicity of chronically ingested strontium-90, radium-226, and plutonium-239 in miniature swine; the effects of temperature and radiation on the incidence of bacterial infection from *C. columnaris* among fish in the Columbia River; atmospheric diffusion in stable conditions; standardization of circuits for use in various types of radiation survey instru-

ments; the determination of the chemical form of isotopes present in reactor effluent water; the use of aluminum turnings to remove isotopes from the effluent water; geology and soil physics of the Hanford plant area; and the deposition of air-borne particles of plutonium from production plant exhaust air. (For preceding period see HW-60137.)

81 HW-64945

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1960. Apr. 27, 1960. 37p. Contract AT(45-1)-1350. OTS.

Data are reported from the following studies: the effect of reactor effluent on the development of young salmon; the toxicity of Sr^{90} - Y^{90} orally administered to trout; the pathological effects of various amounts of Sr^{90} orally administered to miniature swine; the efficacy of tourniquets in preventing transfer from plutonium-contaminated wounds in swine; the fetal uptake, internal dosimetry, and transfer of Zn^{65} to colostrum and milk in gestating ewes; the effects of chelating agents on the excretion of plutonium in rats; the effect of chronic ingestion of Y^{90} in rats; the deposition of $\text{Pu}^{239}\text{O}_2$ particles in the lungs of dogs; the effect of tritium and x rays on the growth of yeast cells; and factors affecting the uptake of Sr^{85} , Ca^{45} , and Zn^{65} by plants. Results are reported from studies on the effect of meteorological conditions on particle diffusion and transport, in which ZnS was used as a tracer to distances of 8 to 16 miles from the source. A complete integrated-monitoring-system proposal was written for future development work concerning all types of radiological instrumentation and methods of data obtaining, transmitting, and recording. Data are presented on the diffusion coefficients of Cs^{137} in clinoptilolite from a CsCl solution and the effects of accompanying ion on adsorption of Sr^{85} on calcareous soil. (For preceding period see HW-63643.)

82 (HW-66306) RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report, April-June 1960. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 5, 1960. 40p. Contract AT(45-1)-1350.

Progress is reported in the following studies: the toxic effects of fission products in reactor effluent on the development of fish; the toxic effects of Sr^{90} fed to miniature swine; the response of skin to intradermal injections of plutonium nitrate; the response of irradiated miniature swine to transplants of fetal hematopoietic cells and adult bone marrow; the effects of chelating agents on the absorption of injected plutonium in swine; the mechanisms involved in gastrointestinal radiation injury; factors affecting the deposition of plutonium dioxide in the lungs of dogs; the toxic effects of inhaled plutonium dioxide in dogs; the radiosensitivity of yeast cells; the uptake of Sr^{85} , Ca^{45} , and Cs^{137} by plants; levels of fall-out radioactivity in plants and animals collected at Cape Thompson, Alaska, during 1959; the concentration of β -emitting radioisotopes in wild animals from the Hanford area; studies on the diffusion and transport of dust particles using fluorescent tracer particles; the development of design modifications in equipment for use in personnel and environment monitoring programs; the performance of a whole-body radiation monitor; the formation of reactor effluent radioisotopes by the reactions $\text{Al}^{27}(n,\alpha)\text{Na}^{24}$, $\text{Fe}^{54}(n,p)\text{Mn}^{54}$, and $\text{Fe}^{58}(n,\gamma)\text{Fe}^{59}$; the mechanism responsible for the production of Sc^{45} in aluminum reactor process tubes; the effectiveness of alum flocs in removing arsenic from

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river water; effectiveness of ion exchange materials for the separation of Na^{24} , Zn^{65} , Np^{239} , and Cr^{51} from water; the geology of the Hanford area; the effectiveness of sampling wells in monitoring the water in an aquifer; the influence of solution pH on anion replacement reactions in soil; laboratory research to characterize the soil chemistry of rare-earth elements; mineral fixation of high-level wastes; parameters controlling the deposition of particles in conduits due to turbulent diffusion; and the efficiency of filters in removing air-borne fission products. (For preceding period see HW-64945.)

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CELL PHYSIOLOGY

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MODIFICATION OF RADIATION EFFECT ON MAMMALIAN TUMOUR CELLS BY PHARMACOLOGICAL AGENTS. R. J. Berry and J. R. Andrews. Nature (London) 196, 185-6(1962) Oct. 13

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PHOSPHORUS-32 INCORPORATION BY EHRlich ASCITES CELLS IN VITRO. E. H. Creaser, R. P. De Leon, and P. G. Scholefield (McGill-Montreal Gen. Hosp. Research Inst., Montreal, Can.). Cancer Research 19, 705-12(1959). CA 53-20483c

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ACTION OF TRITIATED THYMIDINE ON THE CLONAL

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GROWTH OF MAMMALIAN CELLS. Ruth M. Drew and Robert B. Painter (Brookhaven National Lab., Upton, N. Y.). Radiation Research **11**, 535-44(1959) Oct.

The effect of intracellular incorporation of tritiated thymidine (H^3 TDR) on mammalian cell cytology and survival has been investigated by the single-cell plating technique. A survival curve of HeLa S3 cells grown in medium containing H^3 TDR has been constructed which demonstrates the lethal action of the radioisotope. At concentrations of 0.1 μ C/ml or greater, very few cells survive and continue to divide to form macroscopic colonies in the plate cultures. The lethal action of H^3 TDR has been shown to be a function of both the dose and the specific activity. The cytological appearance of the cells is changed as a result of exposure to H^3 TDR. Giant cell formation, loosely packed cells, and abortive colonial growth all indicate a radiation effect. No reversal of the killing effect could be demonstrated when H^3 TDR-treated cells were grown over nonmultiplying, x-irradiated feeder cells.

102 FURTHER STUDIES ON THE CLONAL GROWTH IN HeLa S3 CELLS TREATED WITH TRITIATED THYMIDINE. Ruth M. Drew and Robert B. Painter (Brookhaven National Lab., Upton, N. Y.). Radiation Research, **16**: 303-11(Mar. 1962).

The effect of intranuclear incorporation of H^3 -thymidine on the clonal growth of HeLa S3 cells was studied, and the suppression of colony development was shown to be a function of the variability of the uptake of the radioisotope by cells within clones. Autoradiograms showed that in young cultures the percentage of clones in which all cells were labeled after a 24-hr growth period in medium containing 0.1 μ C of H^3 -thymidine per milliliter was much greater than in older cultures having an average of about forty cells per clone. When similar cultures were permitted to incubate in nonradioactive medium after the growth period in radioactive medium, there was a greater suppression of colony development in the younger cultures than in those with more cells per clone. Variability in the uptake of H^3 -thymidine by cells within clones was demonstrated to be a function of the degree of variability in the generative cycle of cells. A small fraction of cells appears to have a somewhat longer generation time than the average (22 to 24 hr). If the incubation time in the radioactive medium is extended to 48 hr, these cells incorporate the radioisotope, and colony development is completely suppressed. Survival curves for S3 cells cultured in varying concentrations of H^3 -thymidine for 24 and 48 hr were established for comparison. Both curves indicate that a concentration of H^3 -thymidine of the order of 0.02 μ C/ml suppresses colony development. The lethal effect at this dose level is significant in the 48-hr treated cultures.

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112 CONSERVATION OF RIBONUCLEIC ACID (RNA) AND DEOXYRIBONUCLEIC ACID (DNA) PHOSPHORUS IN STRAIN L (Earle) MOUSE CELLS. A. F. Graham and L. Siminovitch. (Univ. Toronto, Can.). Biochim. et Biophys. Acta **26**, 427-8(1957) (In English). CA-52-3097b.

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ALPHA IRRADIATION OF PARTS OF SINGLE CELLS IN TISSUE CULTURES. I. TECHNIQUES. II. DOSIMETRY. T. R. Munro (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Exptl. Cell Research **15**, 529-50 (1958) Dec.
Techniques are described for the following: growing chick heart fibroblasts under conditions which permit single cells to be subjected to micromanipulation; making tungsten micro-needles; depositing polonium upon their tips; and sealing this in position by an electro-deposited layer of chromium. The micro-needles serve as sources of alpha particles which have a well-defined, measurable range of 20 to 35 microns, depending upon the thickness of the chromium. They can be used to irradiate parts of single cells in tissue cultures.
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AUTORADIOGRAPHIC EVIDENCE OF DISTRIBUTION OF METHIONINE-S³⁵ IN EHRlich ASCITES CELLS. V. Mutolo, G. Giudice, and A. Di Miceli (Cancer Research Center, Palermo, Sicily). Exptl. Cell Research **15**, 434-5 (1958). CA 53-22412h
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TID-7578 (p.131-7)
Brookhaven National Lab., Upton, N. Y.
THE USE OF TRITIATED THYMIDINE IN RADIOBIOLOGICAL STUDIES WITH MAMMALIAN CELL CULTURES. Robert B. Painter and Ruth M. Drew. 7p. (BNL-4101).
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SERUM ALBUMIN PRECURSOR IN CYTOPLASMIC PARTICLES. Theodore Peters, Jr., Anne C. Logan, and Catharine A. Sanford. (Mary Imogene Bassett Hosp., Cooperstown, N. Y.). J. Biol. Chem. **229**, 659-77 (1957). CA-52: 6448a.
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(LAMS-2526 (p.78-88)) DETERMINATION OF TRITIUM BETA ACTIVITY IN MICROGRAM AMOUNTS OF NUCLEIC ACIDS FROM HeLa CELLS CULTURED IN AGITATED FLUID MEDIUM. D. F. Petersen, L. B. Cole, and P. C. Sanders (Los Alamos Scientific Lab., N. Mex.).
A simplified procedure is described for routinely counting tritium β activity in biological materials. Results are reported from studies on the metabolism of labeled thymidine and desoxycytidine involved in the synthesis of desoxyribonucleic acid in HeLa cells grown in an agitated fluid medium. A flow diagram is presented for the separation and quantitative determination of radioactivity in nucleic acid fractions.
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NUCLEIC ACID METABOLISM OF HUMAN MALIGNANT CELLS. A. Pileri and L. Ledoux. (Univ. Brussels, Belg.). Biochim. et Biophys. Acta **26**, 309-12 (1957) (In English). CA-52-3110h.
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INCORPORATION OF PHOSPHORUS-32 INTO ADENOSINE TRIPHOSPHATE OF ADRENAL CHROMAFFIN GRANULES. W. H. Prusoff, H. Blaschko, M. G. Ord, and L. A. Stocken. Nature (Lond) **190**, 354-5(1961) Apr.
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EFFECTS OF D₂O ON CELLULAR COMPONENTS OF MAMMALIAN CELLS GROWN IN TISSUE CULTURE. E. L. Rothstein, R. W. Hartzell, Jr., L. A. Manson, and D. Kritchevsky. Ann. N. Y. Acad. Sci. **84**, 721-6(1960) Nov.
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IRRADIATION OF CELLS IN TISSUE CULTURE. VI. THE INFLUENCE OF OXYGEN ON INJURY TO CELLS BY GAMMA IRRADIATION FROM A COBALT-60 SOURCE. D. E. Rounds, C. M. Pomerat, L. C. Logie, Y. H. Nakanishi, and D. Anderson. Z. Zellforsch. **50**, 425-32(1959)
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PHOSPHOLIPIDE METABOLISM IN HUMAN ERYTHROCYTES. C. E. Rowe. (Natl. Inst. Med. Research, London). Biochem. J. **71**, 1P(1959). CA-53:4470a.
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EFFECT OF X-RADIATION ON UPTAKE OF P-32 INTO INDIVIDUAL NUCLEOTIDES OF HeLa CELLS. R. J. Salmon, L. C. McLaren, M. K. Loken, and D. G. Mosser. Proc. Soc. Exp. Biol. Med. **105**, 15-8(1960) Oct.
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CALCIUM BINDING IN HOMOGENATES OF EHRICH ASCITES TUMOUR CELLS. R. Schofield and D. Thomason. Nature (London) **186**, 656(1960) May 21
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GROWTH OF HeLa CELLS IN HEAVY WATER. B. V. Siegel, R. O. Lund, S. R. Wellings, and W. L. Bostic. Exp. Cell. Res. **19**, 187-9(1960) Feb.
- 161** USE OF RADIOACTIVE ISOTOPES IN STUDYING THE METABOLISM OF MITOCHONDRIA. Philip Siekevitz. p.259-67 of "Radioactive Isotopes in Physiology, Diagnostics, and Therapy. Volume II." Berlin, Springer-Verlag, 1961. (In English)
A summary is given of those aspects of mitochondrial metabolism which are truly specific for mitochondria and for which isotopes have proved to be particularly useful tools. These categories include the turnover of mitochondrial components, the concentration and turnover of low-molecular-weight compounds and ions by mitochondria, and the synthesis and turnover of adenosine triphosphate by the mitochondria.
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H₃ INCORPORATION INTO ASCITES TUMOUR AND TISSUE CULTURE CELLS EXPOSED TO SYNKAVIT AND ITS TRITIATED ANALOGUE. I. Simon-Reuss. Acta Radiol. (Stockh) **56**, 49-56(1961) July
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DNP AND CELL METABOLISM. A. O. M. Stoppani (Univ. of Buenos Aires and Comisión Nacional de Energía Atómica, Buenos Aires). p.143-6 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."
It was shown that 2:4-dinitrophenol in small concentrations inhibits the oxidation of acetate, acetaldehyde, and pyruvate by yeast. The inhibition is selective with respect to the substrates, since the oxidation of glucose, the dicarboxylic acids, or the endogenous substrates is not affected. Synthesis of citric acid by yeast is inhibited by 2:4 DNP. Oxidation of acetate-1-C¹⁴ and of acetate-2-C¹⁴ incorporates C¹⁴ into the yeast in proportion to the acetate oxidized. Distribution of C¹⁴ in the tagged metabolites and in the carbon dioxide fits the view of a citric acid

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cycle. The oxidation of exogenous acetate promotes the oxidation of the yeast's endogenous substrates. The 2:4 DNP prevents oxidation of the radioactive acetate and promotes oxidation of the endogenous substrates which are tagged during the oxidation of the former. The 2:4 DNP selectively inhibits the incorporation of radioactive acetate into citric acid and thus inhibits the operation of the citric acid cycle.

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GROWTH RESPONSE TO Co-60 GAMMA-IRRADIATION OF HUMAN CELL LINES CULTIVATED IN VITRO. II. STABLE CHANGE IN RADIORESISTANCE OF HeLa STRAIN CELLS MANIFESTED THROUGH REPEATED IRRADIATION. K. Takano, Y. Hirokawa, M. Asano, Y. Amenomori, K. Michi. *Jap. J. Med. Sci. Biol.* **15**, 19-27 (1962) Feb.

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HALIDE TRANSPORT IN RED BLOOD CELLS. D. C. Tosteson (Zoophysiol. Lab., Copenhagen). *Acta Physiol. Scand.* **46**, 19-41(1959) (in English). CA 53-17290e

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THE USE OF TRITIATED THYMIDINE FOR MARKING MIGRATORY CELLS. J. P. Trinkaus and Marcie C. Gross (Yale Univ., New Haven). *Exptl. Cell Research*, **24**: 52-7(June 1961). (In English)

Tapetal cells, which may be readily distinguished by their melanin granules, were labeled with thymidine- H^3 and cultured with unlabeled mesonephric cells in mixed aggregates. During five days in culture there was insignificant transfer of isotope to unlabeled cells. In the reciprocal experiment, a small amount of transfer occurred, presumably due to cytolysis of certain labeled cells. It is proposed that thymidine- H^3 has potential usefulness as a marker for migratory cells.

167

CHEMICAL COMPOSITION OF RIBONUCLEIC ACID (RNA) AND SPECIFIC ACTIVITY OF NUCLEOTIDE CONSTITUENTS LABELED WITH PHOSPHORUS IN CULTURED VIRUS-INFECTED CELLS. Gian Luigi Turco (Univ. Turin, Italy). *Minerva nucleare* **1**, 181-4(1957). CA 53-9447d

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A/CONF.15/P/323

PREPARATION OF TRITIUM-LABELED THYMIDINE AND ITS USE FOR THE STUDY, BY THE RADIOAUTOGRAPHIC METHOD, OF THE SYNTHESIS OF DEOXYRIBONUCLEIC ACID IN CELLS BEING CULTURED. W. G. Verly, H. Firket, and G. Hunebelle (Univ. of Liège). 10p.

The biosynthesis of desoxyribonucleic acid was studied in chicken fibroblasts. Autoradiograms were made of tissues following culture in a medium containing tritium-labeled thymidine. Incorporation of labeled thymidine in the nucleus precedes mitosis by about 7 hours and coincides statistically with the increase in quantity of desoxyribonucleic acid in the nucleus as measured by Feulgen's test. At the time of division, the newly formed desoxyribonucleic acid is distributed equally between the two sets of chromosomes that are to form the nuclei of the daughter cells. After three days of contact with tritium-labeled thymidine, there remain some nuclei that are not labeled. These nuclei do not seem to participate in the mitotic cycles; the technique employed shows no synthesis of des-

oxyribonucleic acid. There is no turnover of such nucleic acid, nor exchange of its thymidine fraction.

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EFFECT OF CALCIUM IONS ON THE BINDING OF CHROMIUM-51 TO ERYTHROCYTES IN VITRO. G. von Ehrenstein and B. Zacharias (Univ. Stockholm). *Nature* **182**, 1384-5(1958). CA 53-8217g

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VITAMIN B AND PROTEIN BIOSYNTHESIS. III. VITAMIN B_{12} COMPLEX: NATURE OF THE INCORPORATION ENZYME PRESENT IN CELL SUPERNATANT LIQUID. S. R. Wagle, Ranjan Mehta, and B. Connor Johnson. (Univ. of Illinois, Urbana). *Arch. Biochem. Biophys.* **72**, 241-3(1957). CA-52-3063f.

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TURNOVER OF NUCLEIC ACIDS IN A NONMULTIPLYING ANIMAL CELL. J. W. Watts and H. Harris (Univ. Oxford, Engl.). *Biochem. J.* **72**, 147-53(1959). CA 53-14279g

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INCREASE OF CELLULAR CONSTITUENTS IN X-IRRADIATED MAMMALIAN CELLS. G. F. Whitmore, J. E. Till, R. B. L. Gwatkin, L. Siminovitch, and A. F. Graham. (Univ. Toronto, Can.). *Biochim. et Biophys. Acta* **30**, 583-90(1958) (in English). CA-53:6319c.

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THE INCORPORATION OF RADIOACTIVE PHOSPHORUS IN THE LEUCOCYTE DURING THE EXTRUSION OF PROTEIN INDUCED BY STAPHYLOCOCCAL LEUCOCIDIN. A. M. Woodin and A. A. Wieneke. *Biochem. J.* **87**, 480-7(1963) June.

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NUCLEIC ACID SYNTHESIS IN DIVIDING CELLS. Philip S. Woods and J. H. Taylor. (Brookhaven Natl. Lab., Upton, N. Y.). *Proc. Intern. Congr. Genetics*, 10th, Montreal, Canada **2**, 320-1(1958). CA-52: 20458f.

ECOLOGY

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(TID-12432) PRELIMINARY REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS (P^{32}) IN A MICHIGAN TROUT STREAM. Progress Report, June 14, 1958-March 11, 1959 on A STUDY OF PRODUCTIVITY IN A STREAM ECOSYSTEM. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan Inst. for Fisheries Research, Ann Arbor). Contract AT(11-1)-655. 28p.

On Aug. 5, 1958, an addition of P^{32} was made to the West Branch of the Sturgeon River in the vicinity of Wolverine, Mich. The objectives of the experiment were to determine how the naturally occurring P of a trout stream is used by plants and animals and to determine by what mechanisms P is transported in a trout stream. The information will be used to understand how P in the form of fertilizers can be used in streams to increase the production of trout. Data are presented on the activity of stream water during passage of the isotope, and the activity of plants, invertebrate animals, and fish collected at various times. Results

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indicate that the natural P of the stream water is continuously being exchanged with the P in living plants and animals.

- 176 (TID-12433) A SECOND REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS (P^{32}) IN A MICHIGAN TROUT STREAM. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan. Inst. for Fisheries Research, Ann Arbor). 1959. Contract AT(11-1)-655. 33p.

Phosphorus-32 was released in the West Branch of the Sturgeon River, Michigan, on July 8, 1959, at a theoretical maximum concentration of 1.22×10^{-5} mc/ml. Studies were made on the movement of radiophosphorus through the food chain during a two-month period. Data are presented on total water activity at various collecting stations during passage of the isotope, the activity of solids filtered from the water, the activity of plants collected at various stations throughout the experimental period, the activity of bottom-dwelling invertebrates, the activity of insects, and the activity of fish collected at various locations. Results are compared with results from a similar study done in 1958.

- 177 (TID-12309) A THIRD REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS (P^{32}) IN A MICHIGAN TROUT STREAM. Progress Report. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan. Inst. for Fisheries Research, Ann Arbor). 1960. Contract AT(11-1)-655. 20p.

Results are reported from a study on the incorporation of P^{32} into the food chain in a fresh water stream. Radioactivity in water, plants, insects, invertebrate animals, and fish was measured following the introduction of a concentration of 1.22×10^{-5} mc/ml of P^{32} into waters of the West Branch of the Sturgeon River, Mich. Results are compared with results from similar studies between 1958 and 1959. An attempt was made to relate uptake to the amount of P present. The influence of chelating agents on the distribution of activity was also studied.

- 178 THE ACCUMULATION OF Y^{90} FROM AN EQUILIBRIUM MIXTURE OF Sr^{90} - Y^{90} BY ARTEMIA SALINA (L.). Howard Boroughs, Sidney J. Townsley, and Winifred Ego (Univ. of Hawaii, Honolulu). Limnology and Oceanog. 3, 413-17(1958) Oct.

Artemia salina (L.) was chosen as a representative organism in the second trophic level for studying one phase of the process of transfer of radionuclides through a marine food chain. Adult Artemia were cultured in filtered sea water which contained Sr^{90} - Y^{90} . They were not fed during the experiment which lasted 92 hours. They were removed at intervals, washed, and their radioactivity determined with an end-window counter. At 16 hours the concentration of radioactivity in the Artemia was about 40 times that of an equal weight of sea water. The radioactivity decayed at a rate which was similar to the decay rate of Y^{90} . It was estimated that only about 5 per cent of the activity remaining at secular equilibrium was due to Sr^{90} , the remainder being Y^{90} . This biological fractionation of Sr^{90} - Y^{90} may affect the transfer of these hazardous nuclides through food chains leading to human food. The fractionation of these nuclides by laboratory glassware is briefly discussed.

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- ZINC-65 LEVELS IN OYSTERS IN THE THAMES RIVER (CONNECTICUT). B. W. Fitzgerald, J. S. Rankin and D. M. Skauen. Science 135, 926(1962) Mar.

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- RADIOISOTOPIC TRACING OF THE MOVEMENT OF AN ESSENTIAL ELEMENT THROUGH AN AQUATIC COMMUNITY WITH SPECIFIC REFERENCE TO RADIOPHOSPHORUS. R. F. Foster (General Electric Co., Richland, Wash.). Publ. staz. zool. Napoli 31, Suppl. 34-69(1959). (In English)

Radioisotopes may be used to trace the metabolism of substances through entire ecosystems and thus provide information available by no other means. The Columbia River below the Hanford reactors provides an unusual opportunity for the study of the uptake of radioisotopes by aquatic organisms since the organisms are chronically exposed to a fresh supply of isotopes introduced more or less continuously with the reactor effluent. The specific activity of the P^{32} in Columbia River water thus remains approximately constant throughout much of the year. The specific activity of Columbia River organisms is less than that of the water since radioactive decay of the P^{32} occurs in each trophic level. The decrease in specific activity is in direct proportion to the turnover time for the particular organisms and their position along the food chain. Since most aquatic animals are poikilothermic, their metabolic rates, and thus their turnover rates for phosphorus, change with variations in temperature and so with the season. At low temperatures the turnover time is relatively long, the specific activity is correspondingly low, and the concentration of the isotope in the animal is proportionately low. The reverse is true when temperatures are high. Once the rate constants for biological turnover of appropriate isotopes are established, the observed concentrations of isotopes in animals may be used to estimate feeding rates. Fish that inhabit the Columbia River downstream from the reactors accumulate some of the radioactive materials introduced with the reactor effluent. Although the amounts of isotopes picked up by the fish are too small to cause any detectable radiation damage or to constitute a hazard to persons who eat them, the deposited nuclides can easily be measured. Many of the whitefish (Prosopium sp.) that are taken as samples upriver from the reactors, contain P^{32} . The presence of this artificial isotope indicates an upstream migration of this species during the spring and late fall. 45 references.

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- (UW-SA-2688) RELATIONSHIPS BETWEEN THE CONCENTRATION OF RADIONUCLIDES IN COLUMBIA RIVER WATER AND FISH. R. F. Foster and Dan McConnon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 25, 1962]. Contract AT-(45-1)-1350. 24p.

The uptake of radionuclides by fish is a function of a number of interacting factors which results in wide variability. This variability is sufficiently great so that a large number of samples collected over at least one year's time is necessary in order to determine the average concentration in the fish and fluctuations with time, at least in the case of radionuclides with relatively short effective half-lives. Concentration factors derived on theoretical basis which assume a high rate of intake by the fish throughout the year will substantially overestimate the quantities of

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radionuclides which will accumulate in the fish. This generalization should hold for radionuclides with effective half-lives of several weeks or less in ecological conditions subject to wide variations between seasons.

182 A/CONF.15/P/177

STUDIES ON SOIL-PLANT-ANIMAL INTERRELATIONSHIPS WITH RESPECT TO FISSION PRODUCTS. Lars Fredriksson, Bengt Eriksson, et al. (Royal Agricultural Coll., Uppsala). 63p.

Studies on the incorporation of fission products in food-chains have extended over several years. Data are reported from studies on plant uptake of strontium-90 and cesium-137 from soils, plant-animal interrelationships with respect to the absorption of strontium-90, and the transport of long-lived fission products in Swedish soils.

183

THE OCCURRENCE, EFFECT AND UTILIZATION OF SPECIFIC ISOTOPES IN THE ENVIRONMENT; REVIEW AND DISCUSSION OF BARIUM. N. R. French. *UCLA Sch. Med.* 497, 19(1961) Dec.

184

ESTIMATION OF THE LEVELS OF CAESIUM-137 IN SEA-WATER BY THE ANALYSIS OF MARINE ORGANISMS. R. Fukai and N. Yamagata. *Nature (Lond)* 194, 466(1962) May 5

185 RADIATION IN ECOLOGY. Manuel Nieto Garcia (Junta de Energia Nuclear, Madrid). *Energia Nucl. (Madrid)*, 7: No. 26, 27-41(Apr.-June 1963). (In Spanish)

The effects of radiation on an ecological system are reviewed. The radiation sources and the ecological system are first defined. The trophic structure of this system is briefly described, and the ecological pyramid is discussed. The chemical composition of the ecological system and uptake mechanisms are given. The existence of thermal variations and their effects on the ecology are discussed. The response of the ecological system to radioactive contamination is considered. 23 references.

186

ENVIRONMENTAL CONTAMINATION AND GRAZING ANIMALS. R. J. Garner. *Health Phys.* 9, 597-605(1963) June

187

A SEX DIFFERENCE IN RADIOACTIVITY OF ARTEMIA CULTURED IN SEA WATER CONTAINING PHOSPHORUS-32. Daniel S. Grosch (North Carolina State Coll., Raleigh) and Mary Ellen Plumb (Marine Biological Lab., Woods Hole, Mass.). *Nature* 183, 122-3(1959) Jan. 10.

Phosphorus-32 was added in known concentration to sea water containing adult brine shrimp, *Artemia salina*. Geiger-Mueller counts were made of individual adults and of samples of the sea water over a significant period of time. Females were found to be more radioactive than males. The possible importance of sex in radioecological studies is discussed.

188

(HW-72500(p.139-43)) **RADIOISOTOPES IN STUDYING WATERFOWL DISPERSION.** W. C. Hanson and A. C. Case (General Electric Co. Hanford Atomic Production Operation, Richland, Wash.).

A method to investigate dispersion of waterfowl is described in which heads from birds harvested by hunters are

analyzed for radioisotopes originating from the Hanford reactors. Initial results indicated migration pattern and that 41% of the waterfowl harvested within a fifty-mile radius of the Hanford Reservation during the 1960 to 1961 hunting season were tagged with P³² from the Columbia River.

189 (TID-13108) THE USE OF RADIOPHOSPHORUS IN DETERMINING FOOD CHAIN RELATIONSHIPS IN THE AQUATIC ENVIRONMENT. Final Report. Dale A. Hoffman (Colorado State Univ., Fort Collins) and John R. Olive (American Inst. of Biological Sciences, Washington, D. C.). [1961]. Contract AT(11-1)-398. 46p.

Experiments were conducted to determine the accumulation and concentration of P³² by a simple food chain consisting of green algae, microcrustaceans *Daphnia*, and Green Sunfish in river water. The accumulations and concentration factors of the organisms were found to be greater at 25 than at 10°C. The results indicate that the algae increased the amount of P for *Daphnia* in the first 24 hr and decreased P after longer periods, and that the amount of P³² accumulated by *Daphnia* is proportional to the amount of surface area available for P adsorption. Data were obtained on the acquisition of P³² by the sunfish from various food-chain combinations.

190

THE ACCUMULATION OF RADIOELEMENTS IN CERTAIN GROUPS OF WATER ORGANISMS. D. I. Il'in, Yu. I. Moskalev, and A. I. Petrova. *Atomnaya Energ.* 5, 171-4(1958). (In Russian)

Studies of radioactive element accumulations in live organisms in a water basin with 2 to 4×10^{-8} c/l specific activity indicated selective uptake of P³², Sr⁸⁹, Sr⁹⁰, Cs¹³⁷, and Na²⁴ in plankton, benthon, and fish. The concentration of P³² is higher by an order of three to four in fish, plankton, and deep-sea organisms than in water, and Sr⁸⁹, Sr⁹⁰, and Cs¹³⁷ by an order of two to three. The accumulations of β -active elements found in fish organs were principally in the muscles (44 to 59%) and in the skeleton (16 to 24%). The accumulation of β -active elements in skeleton, gills, fins, and scales is 3 to 5 times higher than in the soft tissues.

191

RADIOISOTOPES IN ECOLOGICAL AND BIOLOGICAL STUDIES OF AGRICULTURAL INSECTS. D. W. Jenkins (Army Chemical Corps, Fort Detrick, Frederick, Md.). p.1-21 of "Radioisotopes and Radiation in Entomology." Vienna, International Atomic Energy Agency, 1962. (In English)

Research completed or in progress on the use of radioisotopes in biological and ecological studies of insects of agricultural and veterinary importance is summarized, and new avenues of approach for insect-control using radioactive materials are suggested. The many uses of radioisotopes are discussed and the various radioisotopes used are listed. 118 references are given.

192

(TID-11355) **ASSIMILATION OF RADIOACTIVE PHOSPHORUS IN HYALELLA AZTECA** (thesis). Robert Frederick Johnson (Iowa State Univ. of Science and Technology, Ames). 1960. 38p. Contract AT(11-1)-59:11.

Results are reported from a study of methods for assaying the role of microcrustaceans in the transfer of solar energy. *Hyalella azteca*, commonly called scuds, were selected for study as representatives of an intermediate link in the food chain from production of organic matter by plants to utilization by fish. Phosphorus-32 was selected

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as a labeling agent for controlled feeding experiments. Procedures are described. An analysis of variance showed that the P^{32} uptake by *H. azteca* from bacteria and from concentrations of algae is additive and independent. Factors that affect the feeding and rates of assimilation of phosphorus by *H. azteca* are discussed.

193 (TID-11816) BIOLOGICAL, CHEMICAL AND RADIOCHEMICAL STUDIES OF MARINE PLANKTON. Reference No. 61-6. Bostwick H. Ketchum (Woods Hole Oceanographic Institution, Mass.). Feb. 15, 1961. Contract AT(30-1)-1918. 16p.

Progress is reported in a study of the biology, chemistry, and radiochemistry of marine plankton populations from 15 collecting stations in the Atlantic Ocean extending from Montauk Point to the vicinity of Bermuda. A list is included of 17 published papers, 6 papers accepted for publication, and 13 reports on work in progress. These publications describe in detail the progress made. A number of species of oceanic plankton algae were isolated. Nitrifying bacteria were obtained from sea water. A significant amount of organic phosphorus was found in sea water at depths greater than 2000 meters. An intensive study was made of the phosphorus metabolism of unicellular algae, using P^{32} as a tracer. A comparison was made between the uptake of radiophosphorus and radiocarbon by natural phytoplankton populations. A study was continued on the temperature and salinity of the waters over the continental shelf.

194 HW-60127

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ON THE PASSAGE OF PAIRS OF ELEMENTS THROUGH FOOD CHAINS. H. A. Kornberg. May 1, 1959. 37p. Contract W-31-109-Eng-52. \$1.00(OTS).

The relationship of element pairs passing through food chains is discussed. Emphasis is placed on the calcium-strontium-90 and potassium-cesium-137 pairs. Mechanisms are described by which strontium and calcium are passed along food chains. Experimental facts and theory are combined to question the use of element-pair ratios in evaluating hazards of the radioactive member of the pair.

195

PLANKTON AS INDICATOR OF RADIOACTIVE CONTAMINATION OF FRESH WATER RESERVOIRS. G. D. Lebedeva. Med. Radiol. 2, No. 6, 65-9(1957) Nov.-Dec. (In Russian)

Data are given on the intensity of absorption of radioactive strontium by *Daphnia magna*, *Diaptomus amblyodon*, and *Scenedesmus quadricauda*. Experiments concerning the washing out of Sr^{90} from organism of daphnia are also described.

196

CORRELATION OF THE NATURAL RADIOACTIVITY OF THE HUMAN BODY TO THAT OF ITS ENVIRONMENT: UPTAKE AND RETENTION OF RADIUM-226 FROM FOOD AND WATER. H. F. Lucas, Jr. (Argonne National Lab.) Feb. 1961. (ANL-6297) (p.55-66)

197

CLAMS AS INDICATORS OF STRONTIUM-90. D. J. Nelson (Oak Ridge National Lab., Tenn.). Science, 137: 38-9(July 6, 1962).

Fresh water clams concentrate strontium-90 in their shells and may be used as indicators of the Sr^{90} contamination

of their environment. Analysis of data derived from the specific activity of Sr^{90} in shells showed that Sr^{90} released to the Tennessee River system remained in solution and that concentrations to a distance of 500 miles from the release site can be predicted on the basis of the dilution of contaminated White Oak Creek water by uncontaminated Clinch-Tennessee River water.

198 (ORNL-3492(p.95-107)) FOREST STUDIES.

J. S. Olson, G. N. Brown, D. A. Crossley, Jr., et al. (Oak Ridge National Lab., Tenn.).

Computer feedback models have included compartments for woody materials, as a step toward interpreting patterns of forest growth. The positive feedback representing increased photosynthetic rate with increased foliage mass is counteracted by opposing negative feedbacks, representing not only the loss rates from respiration and other processes (litter fall, consumption, translocation) but also a "limiting feedback" related to the capabilities of an area for producing organic matter. Diurnal and seasonal cycles of production were combined in the same model. Further analyses of two- and three-year comparative experiments, in cooperation with the Botany Department of the University of Tennessee, showed different rates of breakdown for several kinds of deciduous leaves measured in the Oak Ridge Reservation and the Great Smoky Mountains. In all environments, leaf species showed large and consistent differences in weight loss of leaves confined in bags of nylon net. Mulberry decayed rapidly to black humus, losing 0.002 to 0.0046 of its total weight per day in different environments. Beech showed the slowest visible signs of decay, with fractional weight losses of only 0.0003 to 0.0012 per day. White oak, Shumard red oak, and sugar maple showed intermediate rates of weight loss and visible destruction. Yearly differences in decay rates emphasize the need for several-year experiments, using closely compared sets of techniques, for drawing generalizations about rates of ecological processes which affect the movement of nutrients or isotopes in contrasting environments. Seasonal measurements of microbial populations of four leaf species in three contrasting forest types during the first year showed a highly significant correlation between leaf weight loss and microbial respiration, especially that of bacteria. Seasonal fluctuations of microbial respiration were primarily correlated with temperature, but other significant correlations were found with bacterial counts, moisture content of the leaves, and age of the litter. The large-scale tracer experiment employing Cs^{137} in a small stand of yellow poplar is confirming the expectation of rapid circulation of Cs^{137} through the forest ecosystem. The rapid attainment of maximum foliage concentrations in June was followed by a decrease throughout the growing season. Evidence was found of a marked withdrawal of Cs^{137} from the leaves back into the trunk prior to leaf fall. Rainwater collections further supported the possibility that in late summer there is a period in which alkali metal reserves are remobilized into the tree. Paper chromatography analyses, autoradiograms, and column elution tests showed that the bulk of Cs^{137} activity is in the phloem tissue (parenchyma), where it exists only in the ionic form, and that only ionic bonding takes place between the cesium and the wood. In addition to Cs^{137} income from rainfall and litter fall, downward movement of Cs^{137} in roots of tulip poplar apparently provides an important contribution of this nuclide into the soil (Emory silt loam) of the tagged forest. Early litter sampling on lines on a close spacing (2 cm) showed very abrupt variation, due partly to uneven movement of rainout

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over the incomplete litter cover of the mull humus. The extent of variation within centimeter distances was greater than two orders of magnitude. Early sampling indicated the importance of root contribution to the highly variable initial distribution. Root fragments which could be separated from inorganic soil particles contributed at least 90% of the total activity as of July 16, 1962. Fine rootlets that could not be separated from sieved mineral soil may already have contributed to radioactivity in this and subsequent samples. Wide differences in concentrations of Cs^{137} were found in mushrooms growing on the tagged forest floor. This variability was not only the result of large differences among substrates but also the result of differences within one substrate at different locations. Concentrations of Cs^{137} in litter were from 0.1 to 68 times lower than the concentrations in the underlying soil and roots. Variations in concentrations of Cs^{137} in mineral soil exceeded two orders of magnitude for surface samples taken only 10 cm apart. Two types of food chains are being compared in the tagged forest: the green foliage-herbivorous arthropod-predaceous arthropod type of food chain and the leaf litter-herbivorous arthropod-predaceous arthropod type. Cs^{137} concentrations were lower in the leaf litter-soil arthropod food chain than in the green foliage food chain, since leaching of cesium from green leaves was the radioisotope source for the litter layers. Radioisotope concentration in leaf litter increased gradually during the summer and abruptly during the early autumn as leaf fall progressed. During the summer months herbivores had Cs^{137} concentrations almost as high as the concentration in leaf litter. Herbivore radioactivity increased in the autumn but not as rapidly as did leaf litter radioactivity. Predators also showed an increase in Cs^{137} content during the summer and early autumn. During July and August the herbivore and predator parts of the leaf litter-soil arthropod food chain had an added input due to direct feeding on the green foliage. Phalangids (*Lio-bunum* sp.), for example, had Cs^{137} contents which were a factor of 2 or more higher than leaf litter concentrations. Also, some of the predators were evidently feeding in the green foliage food chain although they were trapped on the forest floor. The result was that the animal portions of the leaf litter food chain appeared abnormally high during July and August. In October the green foliage had disappeared, and the leaf litter food chain assumed a Cs^{137} distribution resembling that of the green foliage food chain.

199 A/CONF.15/P/392

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ABSORPTION OF CESIUM-137 BY COMPONENTS OF AN AQUATIC COMMUNITY. Robert C. Pendleton and Wayne C. Hanson. 10p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Results are reported from studies on the uptake of radioactive cesium made by radiochemical analyses of field collections from an impoundment contaminated by fission products from a separations plant, and controlled experiments with cesium-137. Although uptake of this element from soils by terrestrial plants is low, concentration factors of more than 5000 are demonstrated for aquatic organisms. Sorption by the biota coupled with adsorption on inorganic surfaces removed 95% of the original contamination within two days, and 99% within six days. Absorption rates varied according to habitual and trophic levels. Algae and other submerged plants became radioactive very rapidly, and

animals feeding on these plants also had a high rate of uptake, since they were getting cesium from three routes, i.e., that absorbed by the plant, that absorbed on the plant surfaces, and from direct sorption. Carnivorous forms accumulated the element at a slower rate, and emergent plants had the least rapid build up. The rate of uptake was not related to ultimate contamination levels in many forms. The effect of trophic levels upon the degree of contamination is discussed, and the routes through which cesium-137 may be transferred from the aquatic environment to terrestrial forms are delineated. Comparative levels of contamination reached by twenty-seven representative aquatic species under experimental and field conditions are reported. The maximum deposition site for Cs^{137} was in the gonads of fish, muscle of frogs and waterfowl, and roots and plants. The results of these studies indicate that cesium-137 is more mobile under aquatic conditions than in soils. Also, the availability of cesium-137 at levels approaching its accepted MPC in drinking water results in unsafe contamination of fish, frogs, waterfowl, and forage that might be consumed by domestic animals.

200 HW-59500(p.42-6)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECTS OF SOME ENVIRONMENTAL FACTORS ON BIOACCUMULATION OF CESIUM-137 IN AN AQUATIC COMMUNITY. R. C. Pendleton. 5p.

Algae, submerged seed plants, grass, fish, and amphibians changed Cs^{137} contamination levels in response to temperature variations. Shading reduced uptake by submerged plants, and emergent plants rooted in gravel accumulated more Cs^{137} than those rooted in mud. Contamination levels in all organisms decreased because of loss to bottom mud and dilution by increased biomass. Highest contamination generally occurred in the highest trophic levels.

201 (TID-15963) RATES AND PATTERN OF MOVEMENT OF RUBIDIUM⁸⁶ AND PHOSPHORUS³² IN A CENTRAL MESOPHYTIC FOREST, PARKE COUNTY, INDIANA. Annual Progress Report. Robert Petty (Wabash Coll., Crawfordsville, Ind.). Feb. 25, 1962. Contract AT(11-1)-1006. 54p.

Terrestrial mineral cycling in a central mesophytic forest was studied at the Allee Memorial Woods in West Central Indiana. The Allee Woods has been under continual ecological study for the past 4 years, resulting in a detailed description of the virgin beech-maple forest, midseral oak stand, and an abandoned field used as the reference ecosystems. Selected trees were inoculated with Ru^{86} or P^{32} and the rate of migration from leaves to soil was determined. Data were compared with detailed microclimatic data for the same period as well as microorganism and arthropod population levels.

202

FIXATION AND ELIMINATION OF PHOSPHORUS-32 BY SOME ORGANISMS OF THE BLACK SEA. A. E. Pora, J. Oros, D. Rusdea, F. Stoicovici, and C. Wittenberger. *J. Physiol. (Par)* 53, 449-50(1961) Mar-Apr.

203

CONCENTRATION OF RADIOACTIVE ISOTOPES OF PHOSPHORUS AND STRONTIUM IN FRESH WATER MOLLUSKS. Z. S. Povelyagina and M. M.

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Telitchenko. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 64, No. 2, 79-83(1959). CA 53-22543d

204 (NP-11678) RADIOISOTOPIC BIOCHEMICAL PROBE FOR EXTRATERRESTRIAL LIFE. Annual Progress Report to National Aeronautics and Space Administration. (Resources Research, Inc., Washington, D. C.). Feb. 15, 1962. Contract NASr-10. 92p.

The feasibility of a radioisotopic biochemical experiment for extraterrestrial life detection has been established. A medium has been developed which supports the evolution of detectable levels of radioactive carbon dioxide by representative bacteria, streptomycetes, fungi, and algae within a period ranging from minutes to several hours. The group of test organisms which respond includes aerobes, anaerobes, facultative anaerobes, thermophiles, mesophiles, heterotrophs, phototrophs, spore formers, and non-spore formers. Mixed populations in soils have been tested with excellent response. A number of radioactive substrates have been tested singly and in combinations. The most satisfactory response has been achieved through the combined use of sodium formate- C^{14} and uniformly labeled glucose- C^{14} . Two generations of the instrumentation for the experiment have been fabricated and modifications made to the second model. At the present time the instrument, programmer, and associated electronics weigh approximately one and one-quarter pounds. The soil sample is obtained by ejection of two fifty foot lengths of adhesive impregnated string. The string, with collected soil particles, is reeled back into the culture chamber. Here the radioactive medium is applied, and a solid state radiation detector monitors metabolically evolved labeled gases. The instrument has been successfully field tested.

205 MOVEMENT OF RADIOACTIVE SUBSTANCES IN FOOD CHAINS. R. Scott Russell (Agricultural Research Council Radiobiological Lab., Letcombe Regis, Berks, Eng.). p.164-72 of "Atomic Energy Waste. Its Nature, Use and Disposal." E. Glueckauf, ed. New York, Interscience Publishers Inc., 1961.

When fission products are deposited on the surface of the earth or on water they can be hazardous to man or to animals as sources of external radiation or by their accumulation within the organism itself. The passage of radioactive substances through food chains and factors affecting Sr^{90} /Ca relationships in the total diet are discussed. Procedures are described for mitigating the hazards due to the contamination of agricultural lands by fall-out fission products.

206 THE PASSAGE OF Sr^{90} THROUGH FOOD CHAINS. R. S. Russell. p.140-59 of "Radiostrontium." Strahlenschutz No. 18. Munich, Gersbach & Sohn Verlag, 1961.

An over-all appraisal of the rate at which fission products may enter into food chains under natural conditions is presented under two sets of circumstances, continuous deposition as in world-wide fall-out and a sudden deposition of short duration as would occur from a reactor accident or close to ground zero after an atomic weapon explosion. The mechanism of direct contamination of plants is discussed.

207 ACCUMULATION OF CHEMICAL ELEMENTS BY FRESH WATER ORGANISMS FROM WATER SOLUTIONS. I. CONCENTRATION OF RADIOACTIVE ISOTOPES OF

PHOSPHORUS, ZINC, STRONTIUM, RUTHENIUM, CESIUM, AND CERIUM BY VARIOUS SPECIES OF FRESH WATER MOLLUSCA. E. A. Timofeeva-Resovskaya, E. I. Popova, and G. G. Polikarpov. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 63, No. 3, 65-78(1958). CA-53: 590h.

208 ACCUMULATION OF CHEMICAL ELEMENTS FROM WATER SOLUTIONS BY FRESH-WATER ORGANISMS. II. COEFFICIENT OF ACCUMULATION OF DIFFERENT RADIOISOTOPES BY LIMNAEA STAGNALIS. E. A. Timofeeva-Resovskaya and N. V. Timofeev-Resovskii. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 63, No. 5, 123-31(1958). CA-53:7444g.

209 SPECIFIC ACCUMULATORS OF INDIVIDUAL RADIOISOTOPES AMONG FRESH WATER ORGANISMS. E. A. Timofeeva-Resovskaya, N. V. Timofeev-Resovskii, and E. A. Gileva (Lab. of Biophysics, Ural Branch of the Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 140: 1437-40(Oct. 21, 1961). (In Russian)

The distribution coefficients of 19 different radioisotopes have been determined for 32 kinds of fresh water plants and for 20 kinds of fresh water, animal life. Low accumulation coefficients are found on the average for S^{35} , Ca^{45} , Ge^{71} , Sr^{90} , I^{131} and Cs^{137} . High coefficients are found on the average for P^{32} , Fe^{59} , Co^{60} , Zn^{65} , Ce^{144} , Hg^{203} , Y^{91} , Zr^{95} and Nb^{95} . Average coefficients are found for Cr^{51} , Rb^{86} , Ru^{106} and Cd^{115} . The accumulation coefficients are higher on the average for plant life than for animal life. Specific forms of animal life are noted that show high accumulation coefficients for P^{32} , Co^{60} , Sr^{90} , Y^{91} and Cs^{137} . Single-cell forms of plant life and filamentary seaweed accumulate 6 to 8 different radioisotopes. Seven of fifteen of the radioisotopes are strongly concentrated by 5 kinds of animal life (out of 20 different kinds investigated), and 13 of 19 radioisotopes are strongly concentrated by 10 kinds of plant life (out of 32 kinds investigated). These results show the importance of plant life (especially, filamentary seaweed) in purifying water.

210 HW-48523(Del.)
General Electric Co. Hanford Atomic Products
Operation, Richland, Wash.

CONCENTRATION OF RADIOISOTOPES IN COLUMBIA RIVER WHITEFISH IN THE VICINITY OF THE HANFORD ATOMIC PRODUCTS OPERATION. D. G. Watson and J. J. Davis. Feb. 18, 1957. Decl. with deletions Oct. 27, 1958. 133p. Contract W-31-109-Eng-52.

Results of a study on the uptake of radioisotopes by Columbia River whitefish for the period from June 1950 to December 1956 are presented. Differences in concentrations of radioactive materials as related to geographical location, season, age, specific tissue, and concentration of reactor effluent in the river are discussed. Changes in concentration with cooking were determined. Maximum concentrations of P^{32} on the order of 2×10^{-4} μ c/g of flesh were recorded for sportfishing areas immediately upstream and downstream from the Hanford Atomic Products Reservation. Human consumption of whitefish flesh at the rate of 2.7 pounds per week from public fishing areas during the fall months would produce maximum permissible concentrations of P^{32} .

211 ZINC-65 IN MARINE ORGANISMS ALONG THE OREGON AND WASHINGTON COASTS. D. G. Watson, J. J.

REFERENCES

Davis, and W. C. Hanson (General Electric Co., Richland, Wash.). *Science*, 133: 1826-8 (June 9, 1961).

The concentration of zinc-65 in marine animals and plants near the mouth of the Columbia River is presented. Amounts of radiozinc found in the biota diminished rapidly with the distance from the river mouth. The highest levels were found in plankton, algae, and mollusks. Of the human foods, oysters exhibited the highest levels.

212 (HW-65500(p.183-7)) ZINC-65 IN MARINE MOLLUSKS NEAR THE MOUTH OF THE COLUMBIA RIVER. D. G. Watson, J. J. Davis, and W. C. Hanson. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Levels of Zn⁶⁵ in mollusks from the Columbia River in 1957 and 1959 are presented together with possible factors responsible for interspecies and seasonal changes in concentration.

213 DIRECT AND FOOD-CHAIN UPTAKE OF CESIUM¹³⁷ AND STRONTIUM⁸⁵ IN BLUEGILL FINGERLINGS. Louis G. Williams and Quentin Pickering. *Ecology*, 42: 205-6 (Jan. 1961).

Bluegill fingerling fish, accumulating Cs¹³⁷ and Sr⁸⁵, by way of the *Euglena*-*Daphnia* food chain, show higher concentration and retention of these nuclides after 48 hours than by direct uptake from water. Apparently some of these radionuclides, which have been taken up by *Euglena*, are bound to a chemical mechanism. This bound condition enables them to pass along a food chain through *Daphnia* into bluegills. Thus, higher concentrations and retentions of these radionuclides were obtained from the food chain route than from solutions in which the organisms were submerged. (Public Health Eng. abstr., 61: No. 6, 1961)

214 ENVIRONMENTAL CONTAMINATION WITH IODINE-131 IN JAPAN. N. Yamagata and K. Iwashima. *Nature (Lond)* 193, 892 (1962) Mar.

215 ENVIRONMENTAL CONTAMINATION WITH SHORT-LIVED RADIONUCLIDES IN JAPAN IN 1961. N. Yamagata and K. Iwashima. *J. Radiat. Res. (Tokyo)* 3, 48-62 (1962) Mar.

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216 INHIBITED OVIPOSITION BY FEMALES OF *GRYLLUS ASSIMILIS* (F.), INDUCED BY RADIOACTIVE MALES, USING L-METHIONINE-METHYL-¹⁴C. A. A. Abdel-Malek and D. K. McE. Kevan (McGill Univ., [Montreal]). *Nature*, 192: 681-2 (Nov. 18, 1961).

Results of matings between radioactive and normal or non-radioactive individuals of *Gryllus assimilis* (North American field crickets) are reported. The treatment of males with L-methionine-methyl-carbon-14 caused inhibition of egg-laying females and sterility of the male itself. This inhibited oviposition applies to both radioactive and normal virgin females when they are mated with radioactive males. However, if the female is mated with a normal male no effect is noticed in normal oviposition whether the female is normal or radioactive. As a matter of fact, it appears that the radioactive female lays more eggs when mated with a normal male.

217 (AEC-tr-5142) USE OF RADIOISOTOPES AND RADIATION IN THE FIELD OF PLANT PROTECTION.

S. V. Andreev, B. K. Martens, and V. A. Molchanova. Translated from p.23-37 of "Proceedings of the Symposium on Radioisotopes and Radiation in Entomology, held in Bombay, December 5-9, 1960." (a publication of the International Atomic Energy Agency, Vienna, 1962. (STI/PUB/38(p.23-37)). 19p.

Extensive investigations are being carried out in the Soviet Union on applications of radioisotopes and ionizing radiation in the control and elimination of insects and microorganisms that attack plants of agricultural interest. Isotopes have been used as tracers to follow the movements of pests and parasites, to define reservoir areas, to determine population size, food cycles, and to establish predatoriness and parasitism among insects, to follow the movement of insecticides within plants and within plant pests, to make a comparative evaluation of toxic agents having a systemic action, and to ascertain the duration of the toxic characteristics of such agents in plants and agricultural produce. The effects of ionizing radiation on microorganisms, seeds, and insects were studied and a gamma irradiation facility was designed for the control of insect pests in stored grains and other seeds.

218 RADIOACTIVE INSECTS? W. Arthur. *Ala. Ag. Exp. Highlights of Ag. Res.* 5, 4 (1959)

219 NOTE ON DISPERSAL OF RADIO-ACTIVE GRASSHOPPERS. W. F. Baldwin and others. *Can. Entom.* 90, 374-6 (1958) June

220 RADIOTRACER LABELING OF A NATURAL TEPHRTID POPULATION AND FLIGHT RANGE OF THE WALNUT HUSK FLY. M. M. Barnes. *Ann. Entom. Soc. Am.* 52, 90-2 (1959) January

221 THE SULFUR METABOLISM OF INSECTS. III. THE METABOLISM OF CYSTINE, METHIONINE, TAURINE, AND SULFATE BY THE HOUSEFLY, *MUSCA DOMESTICA*. Val F. Cotty, S. Mark Henry, and John D. Hilchey. *Contribs. Boyce Thompson Inst.* 19, 379-92 (1958). CA-53:2491e.

222 LABELLING OF BEES BY MEANS OF RADIOACTIVE GOLD. G. Courtois and J. Lecomte. *Int. J. Appl. Radiat.* 5, 265-8 (1959) July

223 COMPARATIVE ELIMINATION OF RADIOCESIUM AND RADIOSTRONTIUM BY GRASSHOPPERS. D. A. Crossley, Jr. and Jay H. Schnell (Oak Ridge National Lab., Tenn.). *Ann. Entomol. Soc. Am.*, 54: No. 2, 459-61 (Mar. 1961).

A difference was found in the relative accumulation of Sr⁹⁰ and Cs¹³⁷ by insects at the White Oak Lake bed, a contaminated radioactive area at the Oak Ridge National Laboratory, Oak Ridge, Tenn. Insects reached Cs¹³⁷ concentrations which were almost as high as concentrations in the plants, but Sr⁹⁰ concentrations in the insects were nearly an order of magnitude lower than the corresponding plant concentrations. This difference was explained by results from laboratory studies with Sr⁸⁵ and Cs¹³⁷ in grasshoppers, which showed that Sr⁸⁵ was eliminated much more rapidly than Cs¹³⁷.

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- 224** INSECT-VEGETATION RELATIONSHIPS IN AN AREA CONTAMINATED BY RADIOACTIVE WASTES. D. A. Crossley, Jr., and Henry F. Howden (Oak Ridge National Lab., Tenn. and Entomology Research Inst., Ottawa). *Ecology*, 42: No. 2, 302-17 (Apr. 1961).
- The development of insect populations on vegetation growing on White Oak Lake bed was followed for 3 years (1956 to 1958), immediately following the draining at White Oak Lake. This lake had served as a final holding basin for Oak Ridge National Laboratory's low-level wastes, and the alluvial terrain exposed upon drainage contained significant concentrations of radioisotopes, including Sr^{90} and Cs^{137} . The insect biomass, estimated by sweep-net and box-trap methods, was about 200 to 300 mg/m². No change could be demonstrated during the seasons, and evidently little change occurred between years. Significant concentrations of both Sr^{90} and Cs^{137} were found in samples of herbivorous insects. Concentrations of Sr^{90} were about 25% of the soil values, and Cs^{137} concentrations were about 1% of the soil values. However, the biomass of insects was minute compared to plant and soil masses, and the herbivorous insects contained but a minute fraction of the fission products in the system, since the bulk of these radioisotopes is in the soil. A sizeable fraction of the materials taken up by plants, however, may pass through the herbivorous insects in the system. Insect populations were followed in 2 areas each of smartweed, sedge-rush, and willow vegetation. Each of the vegetation types acquired its own characteristic insects. First-year insect populations tended to be dominated by one or a few species represented by many individuals. The second-year populations showed a reduction in numbers for the dominant species and an influx of additional species, accompanying an increase in plant diversity. No such reduction of the dominant species occurred in the willow areas, presumably because the willows were increasing their coverage each year, and additional species of plants were not invading the willow stands.
- 225** THE UPTAKE AND ELIMINATION OF CESIUM-137 BY A GRASSHOPPER—*ROMALEA MICROPTERA*. D. A. Crossley, Jr. (Oak Ridge National Lab., Tenn.) and M. E. Pryor. *Health Phys.* 4, 16-20 (1960) Oct.
- Adults of *Romalea microptera*, the eastern lubber grasshopper, were fed cesium-137 in bean plants to investigate uptake and elimination of this isotope. A biological half-life of 4 to 5 days was obtained. In experiments where grasshoppers were allowed to feed repeatedly on cesium-contaminated food, the biological half-life was used to predict the equilibrium values. Most of the ingested Cs^{137} was concentrated in muscular tissue, but some was also found in the digestive tract and reproductive organs. Only trace amounts were found in the exoskeleton.
- 226** MIDGE LARVAE AS INDICATORS OF RADIOACTIVE POLLUTION. La Verne L. Curry (Central Michigan Coll., Mount Pleasant, Mich.). *Purdue Univ., Eng. Bull., Ext. Ser.*, No. 106, 269-80 (Mar. 1961).
- The role of midge larvae, or blood worms, as an indicator or radioactive pollution of surface waters was investigated. The larvae of two species were obtained from a silt deposit and studies were made on larvae ecology and feeding habits and their position in specific food chains. The uptake of Fe^{59} and P^{32} by the larvae was measured. The results of these studies indicate that much has to be learned of the ion exchange between water-hydrosol systems and hydrosol-larvae systems. Both experiments using P^{32} and Fe^{59} indicate that the exchange of the radionuclides at the mud-water interphase occurs within 6 hr and that there is considerable penetration by the radionuclides. It was concluded that the larvae of *T. plumosus* and *T. decorus* cannot be used as indicators of water pollution due to P^{32} and Fe^{59} because of the low rate of uptake by the larvae as compared to the resulting activity of the hydrosol from the water.
- 227** DISPERSAL OF ADULT HIPPELATES PUSIO, THE EYE GNAT. R. P. Dow. *Ann. Entom. Soc. Am.* 52, 372-81 (1959) July
- 228** (HW-69500(p.31-4)) EFFECTS OF Sr^{89} UPON POPULATIONS OF MEAL MOTHS. H. E. Erdman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).
- Populations of *Ephestia*, the Mediterranean flour moth, were cultured on cornmeal spiked with different concentrations of Sr^{89} . Several fitness components were measured to illustrate how insect populations react when irradiation is a chronic environmental factor. All levels of Sr^{89} employed in this experiment were detrimental to the developing organisms; those which attained adulthood reproduced another generation even though reduced in numbers.
- 229** STUDIES ON THE INFLUENCE OF RADIOACTIVE-RAYS UPON THE HEMOCYTES OF THE SILKWORM, BOMBYX MORI, L. IV. ON THE SEXUAL DIFFERENCES BETWEEN THE EFFECTS OF THE INGESTED RADIOISOTOPES ON THE NUMBER OF HEMOCYTES OF THE SILKWORM. Toshioki Gamo, Hisao Nishiyama, and Shigeo Midorikawa (Shinshu Univ., Japan). *Radioisotopes (Tokyo)*, 9: 17-24 (Apr. 1960). (In Japanese)
- Attempts were made to show some sexual differences in the destructive influences of radiation upon the numbers of hemocytes of the silkworm. Just moulted silkworm larva of the fifth stage were administered 0.1 cc of 0.5% solution Ca^{45}Cl or 0.3% solution of $\text{H}_3\text{P}^{32}\text{O}_4$ through the mouth. It was concluded from the results that the largest damage of Ca^{45} and P^{32} was inflicted on the proleucocyte, especially in the male silkworm.
- 230** THE ACCUMULATION AND ELIMINATION OF Sr^{90} AND Cs^{137} BY THE CADDIS FLY HALESUS INTERPUNCTATUS ZETT. A. B. Getsova and G. A. Volkova (Inst. of Zoology, Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 139: 483-4 (July 11, 1961). (In Russian)
- Larvae of the caddis fly were placed in 5 liters of water which had been contaminated with about 1000 counts/minute of Sr^{90} or Cs^{137} . After 3 and 6 hours, 1, 4, and 8 days, a definite number of the insects were removed from the aquarium. Part of the insects were dried, weighed and counted in order to obtain the amount of Sr^{90} and Cs^{137} accumulated by the organism. The remainder of the insects were placed in clean water for 1, 4, and 14 days in order to determine the rate of decontamination. Activity determinations were made on both the cocoon and on the larva. The greatest amount of residual activity is left in both the cocoon and in the larva after an 8-day accumulation of activity as compared to a 3 or 6 hour accumulation of activity. Most of the desorption of activity from the cocoon takes place during the first day. The contamination in the larva is removed more slowly and uniformly.

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- 231** ACCUMULATION AND REMOVAL OF RUTHENIUM-106, CERIUM-144 AND PROMETHIUM-147 BY THE FLY *HALESUS INTERPUNCTATUS* ZETT. A. B. Getsova and G. A. Volkova (Zoological Inst., Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 144: 1163-4(1962). (In Russian)
- Continuing previously published studies (*Doklady Akad. Nauk S.S.S.R.*, 133: (1960) No. 2; *ibid.*, 139: (1961) No. 2.) on the desorption of radioactive materials from water insects, the removal of fission fragments from the fly *Halesus interpunctatus* Zett was investigated by means of the method described in the above-cited papers, taking into account the self-absorption of Pm^{147} . It was found that the residual activity of the insect depended on the length of their stay in the radioactive environment. From larvae, Pm was removed to the greater extent (residual activity 18%), followed by Ce (29%) and Ru (47%); from adult insects about half of the accumulated activity can be removed. Comparison with previous data on Sr and Cs indicated that there is a direct correlation between the period of accumulation and the removal of the radioisotope; Sr and Cs are removed to a greater extent from the adult specimens, Ru, Ce and Pm from the larvae. This is probably due to the ion-exchange type adsorption mechanism of Sr and Cs which can be washed off more easily from the surface of the adult insects.
- 232** BIOLOGICAL RESPONSE TO MIXED RADIATIONS. Daniel S. Grosch, Robert L. Sullivan, and Leo E. LaChance (Marine Biological Lab., Woods Hole, Mass. and North Carolina State Coll., Raleigh). *Nucleonics* 15, No. 12, 64, 66(1957) Dec.
- In reactor and certain accelerator situations radiation is often present as a mixture of radiations. To study the additive effects of such mixtures, a series of experiments was made on the combined sterilizing effects of external x rays and ingested β emitters (P^{32} and Sr^{89}) on the ectoparasitic wasp, *Habrobracon juglandis*. (L.T.W.)
- 233** DISTRIBUTION OF ZINC-65 IN THE WASP, HABROBRACON, AND ITS EFFECTS ON REPRODUCTION. Daniel S. Grosch (North Carolina State Coll., Raleigh). *Nature*, 195: 356-8(July 28, 1962).
- Adults of the habrobracon wasp were fed with Zn^{65} sulfate or exposed externally to Zn^{65} chloride. The radioactivity of whole wasps, body parts, and eggs were measured along with the hatchability of the eggs. Eggs were most radioactive on the third day and egg production was consistently lower than for control wasps. Nearly all the radioactivity in the wasp was abdominal; during the first two days, most of the ingested Zn^{65} was associated with the digestive tract. In the male, the reproductive system did not become appreciably radioactive. Since less than 20% of the Zn^{65} meal is eliminated via the eggs, it is concluded that the effects of Zn^{65} are due to zinc toxicity.
- 234** (ORO-378) THE GENETIC AND DEVELOPMENTAL EFFECTS OF INGESTED RADIOACTIVES IN HABROBRACON. Final Report. D. S. Grosch (North Carolina State Coll., Raleigh). [1960?]. Contract AT(40-1)-1314. 10p.
- Data are summarized from a study on the genetic effects of ingested radioisotopes in the wasp *Habrobracon*. Results demonstrated the ovaries to be the weakest link in the insect life cycle following ingestion of P^{32} by adult females.
- Damage to the gonads was revealed by direct observation of whole mounts of ovarioles and by deenerated egg production and lowered hatchability. The life span was also shortened by ingestion of radioisotopes. S^{35} , Ca^{45} , and Sr^{89} were also fed. Temporary and permanent infecundity and sterility were induced by Sr^{89} , but it was not as effective as P^{32} . The influence of the other two isotopes was seen only in reduced differentiation and hatchability of the most sensitive cell types. A descending order of effectiveness of the isotopes was shown to correspond to the ascending order of their physical half lives. Relatively brief biological half lives complicated the comparison of alkaline earth elements with other isotopes. A list is included of publications resulting from these studies.
- 235** ABSORPTION, METABOLISM, AND EXCRETION OF CARBON-14-LABELED ALLETHRIN BY HOUSE FLIES. Theodore L. Hopkins and Wm. E. Robbins. *J. Econ. Entomol.* 50, 684-7(1957). CA-52: 6704a.
- 236** A/CONF.15/P/1291
L'ABSORPTION INTESTINALE DE $P^{32}O_4H_2Na$ CHEZ *RUTILUS RUTILUS* L. EN FONCTION DE LA QUANTITÉ DE PHOSPHATE DU SANG. (The Intestinal Absorption of $P^{32}HNa_2$ in *Rutilus Rutilus* L., as a Function of the Total Phosphatemia.) Alexandre A. Kudriavtzev (Veterinary Research Inst., Moscow) and A. Eugène Pora (Univ. of Cluj). 9p.
- The intestinal absorption of phosphates in higher animals is inhibited by an increase in the total phosphatemia. This was investigated on roach (*Rutilus rutilus* L.) caught in the lakes around Moscow during November and December of 1957. It was shown that the phosphates dissolved in the external medium reach the bloodstream of the fish through its branchiae. They accumulate in the organs only in very small quantities and are excreted almost entirely by the kidneys. The phosphates contained in the food are absorbed by the intestines. They accumulate in the liver, encephalon, and muscles. If the amount absorbed is large as compared to that which is so accumulated, the phosphates also are excreted by the kidneys. When a large amount of phosphates is supplied in the food, in addition to those absorbed from the external medium through the branchiae, the absorption and accumulation of the former will be reduced. If the accumulation of phosphates following branchial absorption be rated as 1, the deposition following intestinal absorption would be rated at about 50 and that noted for simultaneous branchial and intestinal absorption would be about 10. Thus it is that an increase in the phosphatemia inhibits the absorption and accumulation in the body organs of the phosphates present in the food. Even if it is absorbed, this phosphate is excreted by the kidneys in large amounts, showing that it can be transformed into an organic form which is systemically useful.
- 237** THE USE OF GAMMA RADIATION FROM COBALT-60 IN THE CONTROL OF DISEASES OF THE HONEYBEE AND THE STERILIZATION OF HONEY. H. Katznelson and J. A. Robb. *Canad. J. Microbiol.* 8, 175-9(1962) Apr.
- 238** JPRS-2453
A METHOD OF TAGGING INSECTS BY GIVING THEM RADIOACTIVE ISOTOPES WITH FOOD. G. D. Khudadov.

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Translated from *Byull. Moskov. Obshchestva Ispytateley Prirody, Otdel Biol.* 64, No. 3, 35-45(1959). 21p. OTS.

A study was made to determine the best method of labeling insects using radioactive food. Flies and roaches were used in the study which compared P^{32} , Ca^{45} , Fe^{59} , Zn^{65} , Si^{31} , Y^{91} , Cd^{115} , I^{131} , Ba^{140} , and La in various food preparations. It was found that a 24-hr exposure was required for 100% tagging, the best results being obtained with P^{32} in a mixture of 3 parts milk and 1 part 10% sugar water. A direct relation was found between P^{32} concentration in food and the radioactivity of the flies, and the females were twice as radioactive as males, being twice as heavy. The effects of elimination, isotope decay, and energy of the emitted ray were considered. Radioisotopes with a beta above 0.8 Mev and a half life not less than 1 week are suitable. The food for studies running 10 to 20 days should contain 1 to 3 microcuries.

239 TID-7554(p.527-35)

Department of Agriculture. Beltsville, Md. STUDIES OF INSECTS AND INSECTICIDES WITH RADIOACTIVE MATERIALS. A. W. Lindquist. p.527-35 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 9p.

Entomology is among the scientific disciplines employing radioactive materials in studies on the biology, physiology, toxicology, biosynthesis, disease transmission, and effects of radiation on reproduction, habits, longevity, and control of insects. Flight habits, dispersal distances, migrations, longevity, and population numbers have been studied with specimens tagged with radioactive materials. Results are reviewed from studies on the effects of radiation on insects and studies with radioactive insecticides. Applications in the control of insect pests are discussed.

240

USE OF RADIOACTIVE CARBON FOR LABELING FLEAS. N. S. Novokreshchenova, I. S. Soldatkin, L. K. Denisenko, and L. A. Martens. *Med. Parazit. (Mosk)* 30, 72-6 (1961) Jan.-Feb.

241 STUDIES WITH RADIOACTIVE YTTRIUM IN FLIES. I. RETENTION AND DISTRIBUTION IN *DROSOPHILA* AFTER INJECTION. Per Oftedal (Norwegian Radium Hospital, Montebello, Norway). *Intern. J. Radiation Biol.*, 3: 211-21(Mar. 1961). (In English)

After injection into *Drosophila melanogaster* males, Y^{91} citrate is completely retained. The pattern of distribution is shown to depend upon the injection site, and upon the age of the fly at the time of injection. Microscopically, it is shown that two alternative patterns of distribution occur. The radioactivity is concentrated either in the pericardial cells and the thoracic nephrocytes, or in the hemocytes. The mechanism deciding which of these patterns will obtain is discussed. It is presumed that it depends upon the type of aggregate formed when the Y^{91} citrate is prepared from the solution of $Y^{91}Cl_3$. The findings are discussed, but no definitive explanation can be given.

242 STUDIES WITH RADIOACTIVE YTTRIUM IN FLIES. II. RETENTION AND DISTRIBUTION IN *DROSOPHILA* AND IN *MUSCA* AFTER INGESTION. Per Oftedal

(Norwegian Radium Hospital, Montebello, Norway). *Intern. J. Radiation Biol.*, 3: 222-30(Mar. 1961). (In English)

After ingestion, retention of Y^{91} citrate falls to a few per cent after two to three days in *Drosophila*, a week in *Musca*. This retained radioactivity forms a tail on the retention curve. The retention site in *Drosophila* is shown to be a narrow band of cells in the endodermal mid-gut immediately anterior to the transition to the ectodermal hind-gut. In some flies, there is also a more diffuse and somewhat wider zone containing radioactivity in the middle mid-gut. There is no activity in the pericardial cells, or in the Malpighian tubules. In *Musca* there is no activity in the pyloric region, but most of the activity is found in a region in the middle mid-gut. This zone is situated about one-third anterior from the pyloric region, and covers 10 to 25% of the total mid-gut length. Also, the pericardial structures contain some 5 to 15% of the total activity. The findings are discussed.

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RADIOISOTOPES AND RADIATION IN ENTOMOLOGY. Proceedings of the Symposium on Radioisotopes and Radiation in Entomology held in Bombay, 5-9 December 1960. (International Atomic Energy Agency, Vienna). Proceedings Series. Jan. 1962. 322p. (STI/PUB/38). \$6.50 (IAEA).

Twenty-five papers are included on problems and uses of radioisotopes and radiation as tools in the fight against insects and pests, which damage agricultural crops and livestock. Twenty-four papers are abstracted, one paper on radioactive tracer techniques in insect biochemistry was previously abstracted in NSA.

244

INCORPORATION OF P^{32} INTO THE PHOSPHORUS COMPOUNDS OF THE WAX MOTH LARVAE (*GALLERIA MELLONELLA*). Paulina Włodawer (Nencki Inst. of Experimental Biology, Warsaw). *Acta Biochim. Polon.*, 8: 321-35(1961). (In English)

With the aid of P^{32} , given as orthophosphate, the phosphorus metabolism in the feeding and in the starved wax moth larvae was studied. The P^{32} content of the acid-soluble P fraction, which was very high at completion of the radioisotope ingestion, fell abruptly during the subsequent period of normal feeding. The fall in the specific activity of the acid-soluble P compounds was accompanied by an increase in the specific activities of the phospholipids and nucleic acids. The phospholipid specific activity reached its maximum 24 hr. after cessation of P^{32} ingestion and exceeded the activity of the acid-soluble P fraction. Practically all of the P^{32} excreted by the larvae was found in the polyphosphates. During starvation the fall in the specific activity of the acid-soluble P fraction was less pronounced than during feeding while the changes in the specific activities of the phospholipids and the nucleic acids were rather insignificant. Uniformity of labelling was found to occur in the acid soluble P compounds of the starved but not of the fed larvae.

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RADIOISOTOPES AND THEIR RELATION TO THE GENETIC MECHANISM AND PHYSIOLOGICAL PROCESSES: A CRITICAL REVIEW. R. K. Appleyard (Columbia Univ., New York). p.227-39 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

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Genetic considerations relevant to the presence of radioisotopes in the biosphere are reviewed. Some of the ways in which genetic constitutions of organisms may affect radioisotope burdens and their consequences are considered. Topics discussed include the genetic and species control of uptake and retention, genetic control of response, genetic hazards of irradiation of populations, radiation-induced and natural mutations, the mechanism of radiation induced mutations, transmutation experiments carried out with P^{32} and bacteriophage, the role of calcium as a necessary nuclear component, and the hazards from the transmutation and ionization produced by levels of C^{14} in the biosphere. 63 references.

246

ON THE PROBLEM OF GENETIC AND FETAL INJURY AFTER THOROTRAST INJECTION. W. Boerner, E. Moll, and A. Rummel. Strahlentherapie 113, 479-82(1960) Nov.

247

NUCLEAR THREAT AND HUMAN GENETICS. L. L. Cavalli-Sforza (Università, Pavia, Italy and Università, Parma, Italy). p.34-49 of "Exposure of Man to Radiation in Nuclear Warfare." Amsterdam, London, and New York, Elsevier Publishing Co., 1963.

Data on the genetic effects of radiation are reviewed. It is pointed out that it is impossible to estimate the genetic damage that might result from a nuclear attack since there are difficulties both in estimating mutation rates for man and in estimating the average radiation dose for survivors.

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IMPLICATION OF CHROMOSOME STRUCTURE AND REPLICATION ON HAZARD OF TRITIATED THYMIDINE AND THE INTERPRETATION OF DATA ON CELL PROLIFERATION. Eugene P. Cronkite, Samuel W. Greenhouse, George Brecher, and Victor P. Bond (Brookhaven National Lab., Upton, N. Y.). Nature, 189: 153-4(Jan. 14, 1961).

Labeling of chromosomal desoxyribonucleic acid (DNA) with H^3 -labeled thymidine (H^3 TDR) demands consideration of the probabilities of long term retention of the label and damage to somatic and genetic cells. These are important for the interpretation of results and for consideration of hazards associated with the use of tritiated thymidine in human beings. The model proposed by Taylor, Woods, and Hughes permits prediction of the persistence of the label. The model is based on autoradiographic observations on plant chromosomes labeled with H^3 TDR during replication. In this model each chromosome is considered to consist of two halves (chromatids), both of which replicate. If H^3 TDR is available during DNA synthesis for a finite period, both half-chromosomes will be labeled in their newly formed replicas. On division, all chromosomes of the daughter cells will contain the label in the newly replicated chromatid. Subsequent DNA synthesis proceeds without further availability of H^3 TDR, and newly formed replicas of both labeled and unlabeled chromatids will be unlabeled. In the daughter cells of the second division, on the average half the chromosomes will be labeled, each composed of one labeled and one unlabeled chromatid. After each subsequent division the number of labeled chromosomes per cell will be halved as the originally labeled chromatids become distributed among twice the number of cells. When the synchronously dividing progeny of a labeled cell first exceeds the chromosomal number, the fraction of labeled cells will begin to diminish, since an increasing number of cells will contain a single-labeled chromatid which cannot

subdivide, but must go to one daughter cell, leaving the other totally unlabeled. The extent of crossing-over in somatic and genetic cells of man is not known, but it is unlikely to approach a random distribution, as would be expected of exchangeability on a molecular level. Discrete distributions were computed for the human chromosome number 46 and are represented. It has not been established that the model proposed by Taylor, Woods, and Hughes pertains to mammalian chromosomes. It is now under study in tissue culture systems of human cells. If the expected agreement with the Taylor-Woods-Hughes model is confirmed, it will have a direct bearing on the interpretation of data in the study of cell proliferation, and the somatic and genetic hazard of H^3 TDR in long-term work.

249

THE CONCEPT OF GENETIC LOAD: A REPLY. James F. Crow (Univ. of Wisconsin, Madison). Am. J. Human Genet., 15: 310-15(Sept. 1963).

A previously proposed concept of genetic load by Crow (Human Biol. 30, 1-13(1958) is clarified and defended.

250

CHANGES IN HEREDITY AND IN SOME PHYSIOLOGICAL AND BIOCHEMICAL INDICES UNDER THE EFFECT OF RADIOACTIVE IODINE-131. B. Eftimov, G. Konstantinov, D. Alexiev and B. Amov. Dokl. Bolg. Akad. Nauk. 16, 89-92(1963).

251

TRANSMISSION OF PHOSPHORUS-32 INCORPORATED BY PARENTS INTO DESCENDANTS OF DROSOPHILA MELANOGASTER. B. Faludi, I. Csukas, K. Szeplaky and F. A. Daniel. Nature (Lond) 190, 469(1961) Apr. 29

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BIOSYNTHESIS OF RADIOACTIVE RNA AND DNA PYRIMIDINES FROM THYMIDINE-2- C^{14} . R. M. Fink and Kay Fink (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). Biochem. Biophys. Research Commun., 6: 7-10(Oct. 23, 1961).

Metabolic pathways in the synthesis of ribo- and desoxyribonucleic acids by a Neurospora mutant were investigated following replacement of thymidine used in growth experiments with thymidine-2- C^{14} . Chromatograms prepared from mycelia were scanned with a Geiger counter. Data are tabulated.

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RELATIVE RETENTION OF H^3 AND C^{14} LABELS OF NUCLEOSIDES INCORPORATED INTO NUCLEIC ACIDS OF NEUROSPORA. R. M. Fink and K. Fink. J. Biol. Chem. 237, 2889-91(1962) Sept.

254

(AEC-tr-4401) LETHAL AFTEREFFECTS AFTER INCORPORATION OF P^{32} IN AMOEBA PROTEUS AND THEIR INTERPRETATION BY GENETIC SUBUNITS. H. Friedrich-Frekza and F. Kaudewitz. Translated for (Oak Ridge National Lab.) from Z. Naturforsch. 8b, 343-55 (1953). 43p. (Includes original, 9p.).

The lethal consequences of the incorporation of P^{32} were studied in a clone of Amoeba proteus grown under constant conditions. It was possible to label the individual cells without impairing motility, absorption of nutrition, and dividing capacity. Progeny of these cells were observed for 100 consecutive cell generations. The percentage of lethallities induced by P^{32} was calculated. A comparison of the results of the experiments and controls showed that the

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absorption of radioactive phosphorus by amoeba cells results in an increase of lethality in subsequent generations.

255 RADIATION-INDUCED MUTAGENESIS—A BIOPHYSICIST'S VIEWPOINT. L. H. Gray (Mount Vernon Hospital, Northwood, Middx., Eng.). Abhandl. Deut. Akad. Wiss. Berlin, Kl. Med., No. 1, 1-19(1962).

The forms of damage to the genome that may be expressed as mutation range from gross visible re-arrangements down to an unknown lower limit is probably a change in sequence affecting a few nucleotides. Ideas concerning structural re-arrangements induced by x and γ radiation have to take into account the fact that the induction of a simple break in chromosomes of plants and animals is a much rarer event than was formerly supposed and that, as proposed by Revell, most of the breaks seen at a metaphase have arisen in association with the formation of exchanges. Data from which to decide whether breaks seen after exposure to densely ionizing radiation have arisen in association with exchanges or independently is lacking. Alpha radiation is efficient compared with x or γ radiation. Almost every transit of an α particle through a plant nucleus yields an aberration visible at metaphase. Some of the mutations induced in micro-organisms by x rays as well as uv appear to be changes in the genetic material which are strictly reversible. They are invariably initiated by one ionizing particle but may not be due to energy deposition in a single site. Mutations induced by uv frequently increase in proportion to the square of the dose when the organisms are plated on to a rich medium. On other plating media, both those which depress the yield and those which augment it, the mutation frequency was found to rise almost linearly with dose. It is suggested therefore that the two sites of energy deposition indicated by the square law dependence may be concerned with quite different functions. Work has shown that mutations in spermatogonia and oöcytes by x-ray are dose-rate dependent, and also that the induction of somatic mutations in proliferating plant cells is greatly modified by exposure to a dose of 100 rad or less two hours before the test dose. These facts were examined in the light of a number of investigations which show that the ability of a gene to initiate enzyme synthesis is impaired by a dose which is not much greater than that which causes complete loss of reproductive integrity; a dose, moreover, which corresponds to the deposition of energy by a single ionizing particle anywhere in a region which represents an appreciable fraction of the genome.

256 INCORPORATION OF PHOSPHORUS-32 INTO SALIVARY-TYPE CHROMOSOMES WHICH EXHIBIT PUFFS. Julian D. Gross. (Inst. Animal Genet., Edinburgh, Scot.). *Nature* **180**, 440(1957). CA-52-1492a.

257 EFFECT OF COLCHICINE ON THE UTILIZATION OF THYMIDINE LABELED WITH TRITIUM DURING CHROMOSOMAL REPRODUCTION. L. F. LaCour and S. R. Pelc (John Innes Horticultural Inst., Bayfordbury, Engl.). *Nature* **183**, 1455-6(1959). CA 53-19057a

258 GENETIC AND AUTORADIOGRAPHIC STUDIES OF TRITIATED THYMIDINE IN TESTES OF *DROSOPHILA MELANOGASTER*. W. D. Kaplan and J. E. Siskin (City of Hope Medical Center, Duarte, Calif.). *Experientia* **16**, 67-9(1960) (In English)

Autoradiographic studies were made of *D. melanogaster* larvae at various intervals after removal from a T-containing diet up to 56 hours. The preliminary data show that spermatocytes reduplicate their chromosomes very early and move posteriorly as additional cells are proliferated from the apical spermatogonia. The mutagenic effect of tritiated thymidine was studied genetically. Unquestionably the T produces a mutagenic effect.

259 HW-59500(p.78-80)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SIGNIFICANCE OF GONAD IRRADIATION IN EXPOSURE TO INTERNALLY DEPOSITED PHOSPHORUS-32. B. Kavin. 3p.

Data are presented for the retention of P^{32} in ovary and bone over a period of 56 days following single intraperitoneal administration. Concentrations of P^{32} in ovary decreased as a power function of time, while concentrations in bone remained constant throughout the period of observation. The results suggest that considerations of genetic damage may prove to be the limiting factor in determining maximum permissible limits for P^{32} .

260 GENETIC TRANSFORMATION. I. CELLULAR INCORPORATION OF DEOXYRIBONUCLEIC ACID (DNA) ACCOMPANYING TRANSFORMATION IN PNEUMOCOCCUS. L. S. Lerman and L. T. Tolmach. (Univ. of Colorado, Denver). *Biochim. et Biophys. Acta* **26**, 68-82(1957)(In English). CA-52-1359c.

261 GENETIC EFFECTS OF STRONTIUM-90 INJECTED INTO MALE MICE. K. G. Luning, H. Frolen, A. Nelson, and C. Ronnback. *Nature (London)* **197**, 304-5(1963) Jan. 19.

262 CELL DIVISION: DIFFERENTIAL EFFECTS OF HEAVY WATER UPON THE MECHANISMS OF CYTOKINESIS AND KARYOKINESIS IN THE EGGS OF *ARBACIA PUNCTULATA*. D. Marsland and A. M. Zimmerman. *Exp. Cell. Res.* **30**, 23-35 (1963) Mar.

263 A/CONF.15/P/1351
MUTATIONS OF RICE INDUCED BY RADIOISOTOPE ^{32}P . Isao Masima and Takeshi Kawai (National Inst. of Agricultural Sciences, Japan). 17p.

The mutagenic effect of internal radiations from absorbed phosphorus-32 was examined in rice plants. Characteristics of the radioinduced mutants were investigated to see whether the induced mutations were suitable for plant breeding. Two-hundred and eighty-three mutant lines were obtained which bred true with different characters in the fourth and fifth generation. Field trials over a six year period resulted in some promising lines having high productivity. Some physiological and genetic effects of phosphorus-32 are described. Data are tabulated on yields and characteristics of mutant lines.

264 GENETIC CONTROL OF PHYSIOLOGICAL PROCESSES: CONSIDERATION OF DIFFERENTIAL ION UPTAKE BY PLANTS. W. M. Myers (Rockefeller Foundation and Indian

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Agricultural Research Inst., New Delhi, India). p.201-26 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Differences among species in content of important elements, in their absorption through roots and foliage, and in their transport from roots to aerial parts have been reported by many investigators. Data on chemical composition must be interpreted with caution since composition is influenced so much by factors of environment, stage of maturity of the plant, and plant part analyzed. Nevertheless, there is little doubt that some of the differences among species are attributable to the species themselves, i.e., to their genetic constitution. The somewhat more limited data on variations within species further substantiates the conclusion that genetically controlled differences do exist in content of various elements and in physiological processes involved in their uptake, transport and metabolism. 86 references.

265 INDUCTION OF MUTATIONS AND KILLING OF CELLS IN IRRADIATED SPERMATOGONIA OF DROSOPHILA. Per Oftedal (Norsk Hydro's Inst. for Cancer Research, Montebello, Norway). *Nature*, 199: 1301-2 (Sept. 28, 1963).

In previous experiments Drosophila melanogaster spermatogonia were irradiated in the 20-hr embryo, the induction of sex-linked recessive lethals was observed, and a nonlinear dose effect curve was found. In an attempt to explain the results quantitatively, a mathematical model for the irradiated population of spermatogonia was formulated and tested at doses of 144 and 267 r. Results seemed to support the hypothesis of differential killing as an explanation for the results after acute irradiation of spermatogonia. It was found that protracted irradiations under some conditions may have a higher observable genetic effect than acute treatments.

266 GENETIC AND SOMATIC EFFECTS OF CARBON-14. Linus Pauling (California Inst. of Tech., Pasadena). *Science* 128, 1183-6(1958) Nov. 14

On the basis of information about carbon-14 given by Libby, calculations are made of the predicted genetic and somatic effects of the carbon-14 produced by the testing of nuclear weapons. It is concluded that 1 year of testing (30 megatons of fission plus fusion) is expected to cause in the world (estimated future number of births per year 5 times the present number) an estimated total of about 55,000 children with gross physical or mental defects, 170,000 stillbirths and childhood deaths, and 425,000 embryonic and neonatal deaths. (There is an unknown amount of overlap of these three categories.) These numbers are about 17 times the numbers usually estimated as the probable effects of the fallout fission products from 1 year of testing. In addition, the somatic effects of bomb-test carbon-14 are expected to be about equal to those of fission products, including strontium-90, with respect to leukemia and bone cancer and greater than those of fission products with respect to diseases resulting from radiation damage to tissues other than bone tissue and bone marrow. All of the estimated numbers are subject to great uncertainty; they may be as much as 5 times too high or 5 times too low. The uncertainty in the estimation of the relative effects of carbon-14 and fission products in world-wide fallout is not so great.

267

ANTIVIROGENETIC POWER OF NORMAL AND NEOPLASTIC HUMAN CELLS AND CELLULAR FRACTIONS CULTIVATED IN VITRO. INVESTIGATIONS WITH RADIOPHOSPHORUS-32P. A. Pellegrini, A. M. Passaggio and P. G. Pagano. *Minerva Nucl.* 4, 88-91(1960) Feb.-Mar.

268

CHROMOSOMAL SYNTHESIS OF RIBONUCLEIC ACID AS SHOWN BY INCORPORATION OF URIDINE LABELLED WITH TRITIUM. G. Pelling. *Nature (Lond)* 184, (Suppl. 9), 655-6(1959) Aug. 22.

269

DISTRIBUTION OF CYTOLOGICAL ABERRATIONS AFTER GAMMA IRRADIATION. Guru D. Pershad, S. A. Krane, C. C. Bowen, and H. T. David (Ames Lab., Ames, Iowa). *Radiation Research*, 14: 184-91(Feb. 1961).

Microsporocytes of four horticultural varieties of Lilium longiflorum were exposed to 20, 40, and 60 r of Co^{60} γ -irradiation at pachytene and diakinesis. Bridges and fragments were scored at anaphase I. It was observed that the total damage failed to follow the Poisson distribution. When the analysis was modified on the assumption that only a certain proportion of the damaged cells were scored, an excellent fit was obtained to the Poisson distribution. It is suggested that cells with one or more bridges or fragments might take longer to reach anaphase than cells with no visible damage, and consequently such lagging cells are less apt to be scored.

270

THE HARMFUL GENETIC EFFECTS OF RADIATION. Harold H. Plough (Amherst Coll., Amherst, Mass.). *J. Natl. Med. Assoc.*, 54: 652-7(Nov. 1962).

Evidence relating to the injurious mutagenic effects of ionizing radiation on biological systems is considered from the point of view of animal experimentation and its pertinence to the increasing radiation burden of human populations. Most evidence for harmful genetic effects from at least the higher doses of radiation comes mainly from studies on Drosophila and the mouse. As in Drosophila, mutations in the mouse appear in linear relation to the dose. One difference in the mouse is that the same radiation dose delivered over a longer period produces fewer mutations than higher intensities. This suggests that some repair may occur during chronic doses at the lower rates. It is pointed out that such data may only be converted into estimates of total radiation damage per roentgen from the total number of genes and the demonstration that the mutations observed, whether lethals or selected visibles, show sensitivities which are average for all genes. The average induced rate for the mouse has been calculated to be 21.3×10^{-8} per gene per r, and for certain specific loci in Drosophila the value is $\sim 1.5 \times 10^{-8}$, suggesting that the mammal is about 16 times more sensitive than the insect. From similar data it was calculated that the dose which would double the natural mutation rate for both flies and mice is about 40 r. This is a convenient figure, and may be used for men on the basis of tabulated spontaneous mutation rates. It is suggested that minor increases in the mutation frequency from low level radiation are imaginary hazards, and that a slight increase in selection would remove many of the harmful mutants as they appear. There is some reason to believe that minor genetic changes are corrected at the cellular level. This position is discussed in terms of recent changes in gene theory relating to microbial genetics. This reveals evidence for a mechanism of repair of radiation damage at the level

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of the smallest genetic units. It is possible, or even probable, that such a mechanism operates in premeiotic stages between genes in heterozygous condition in higher organisms. Critical tests have not yet been made, but they might show reduced expression of lethals or semilethals in subsequent generations after radiation, as compared with the results at higher doses. They might appear as so-called conversion which might be interpreted as crossing over by partial replication. It is concluded that the genetic hazards of radiation are overemphasized and that minor deleterious mutations are selected out early or are repaired before they appear.

271

RADIOISOTOPES AND THE GENETIC MECHANISM: ISOTOPIC TRANSMUTATION AND BIOCHEMICAL FUNCTION. David Pratt (Univ. of California, Berkeley). p.123-31 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Incorporated radiophosphorous, P^{32} , inactivates either bacterial viruses or *Escherichia coli* bacteria by means of radioactive disintegrations which take place in their DNA. Of all radioactive disintegrations in the genetic substance, approximately one tenth actually inactivate. Their recoil energy breaks the DNA molecule in which they occur. This P^{32} decay induced death can be used as an experimental tool to study gene function and reduplication.

272

STABILIZATION TO PHOSPHORUS-32 DECAY AND ONSET OF DNA REPLICATION OF T_4 BACTERIOPHAGE. D. Pratt, G. S. Stent, and P. D. Harriman. *J. Molec. Biol.* 3, 409-24 (1961) Aug.

273

RESISTANCE TO CHOLINESTERASE INHIBITORS OF THE ORGANOPHOSPHORUS GROUP IN DIFFERENT STRAINS OF *DROSOPHILA MELANOGASTER*. GENETICAL AND ENZYMIC STUDIES. B. Rasmuson and B. Holmstedt (Roy. Agr. Coll. Sweden, Uppsala). *Kgl. Lantbruks-Högskol. Ann.* 24, 89-99 (1958). CA 53-85221

274

INCORPORATION OF H^3 -CYTIDINE AND H^3 -THYMIDINE INTO GIANT CHROMOSOMES OF *DROSOPHILA* DURING PUFF FORMATION. Geo. T. Rudkin and Philip S. Woods (Inst. for Cancer Research, Philadelphia, Pa.). *Proc. Natl. Acad. Sci. U.S.* 45, 997-1003 (1959). CA 53-22546a

275

RELATIVE BIOLOGICAL EFFECTIVENESS OF BETA-RAYS EMITTED FROM PHOSPHORUS-32. I. COMPARISON OF BIOLOGICAL EFFECTS OF PHOSPHORUS-32 BETA-RAYS AND X-RAYS ON *DROSOPHILA MELANOGASTER* EGGS. T. Rudnicki. *Acta Physiol. Pol.* 12, 145-57 (1961) Jan.-Feb.

276

THE CONCEPT OF GENETIC LOAD: A CRITIQUE. L. D. Sanghvi (Univ. of Michigan, Ann Arbor). *Am. J. Human Genet.*, 15: 298-309 (Sept. 1963).

Difficulties in accepting a provocative scheme by Crow (Human Biol. 30, 1-13 (1958) to evaluate the relative importance of mutational and segregational loci in maintaining our hereditary burden are discussed. The genotype used as standard of comparison in the previously developed mutation model is not the same as the one used in his segregation model. A logical approach will require a fixed

standard of comparison for the two models. A scheme is outlined in which the same genotype is used for evaluating the inbreeding effects on the two types of loci. It turns out that the appropriate test criterion for this purpose should be 1—B/1—A and not B/A as previously suggested. Other points related to the concept of genetic load are also discussed.

277

BIOCHEMICAL MUTATIONS IN *TORULOPSIS UTILIS* FOLLOWING THE ACTION OF IONIZING IRRADIATIONS. E. N. Sokurova and T. M. Volkova. *Radiobiologia* 2, 36-42 (1962)

278

GENETICAL EFFECTS OF RADIATION. A. C. Stevenson (Medical Research Council, Oxford). p.73-93 of "Exposure of Man to Radiation in Nuclear Warfare." Amsterdam, London, and New York, Elsevier Publishing Co., 1963.

The survivors of a nuclear disaster would be a very heterogeneous group in respect to dosage and therefore in respect to temporary or permanent sterility and transmissible damage induced in their germ cells. Possible genetic effects of radiation from a nuclear attack in human populations are discussed.

279

MUTAGENIC EFFECT OF $C1^4$ AND H^3 LABELLED DNA PRECURSORS INJECTED INTO *DROSOPHILA MELANOGASTER* MALES. O. Strommaes. *Canad. J. Genet. Cytol.* 4, 440-6 (1962) Dec.

280

[THE PROCESSES INVOLVED IN GENETICS AND OTHER CELL PROCESSES]. Statement of Dr. J. Herbert Taylor (Columbia Univ., New York). p.304-14 of "Applications of Radioisotopes and Radiation in the Life Sciences."

Applications of tritium as a tracer in studies of the incorporation of thymidine into deoxyribonucleic acid are discussed. Radioautography was used to illustrate the results of chromosome labeling, the distribution of tritium to daughter chromosomes during division, and the order of chromosome reproduction in cells.

281

MODE OF CHROMOSOME DUPLICATION IN *CREPIS CAPILLARIS*. J. H. Taylor (Columbia Univ.). *Exptl. Cell Research* 15, 350-7 (1958). CA 53-22271g

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TRITIUM AND AUTORADIOGRAPHY IN CELL BIOLOGY. J. H. Taylor (Columbia Univ., New York). p.221-8 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Because tritium emits low-energy beta radiation, it is the most useful isotope for high-resolution autoradiography. The relative abundance of hydrogen in most biologically important substances combined with a relatively short half life allows the labeling of cellular components at specific activities that can often be detected at intracellular dimensions by the use of nuclear emulsions. The cells are attached to glass by various cytological procedures and after fixation a wet or fluid photographic emulsion is applied directly to the cell surface and allowed to dry. After exposure the emulsion is developed while still in contact with the biological specimen. The preparation, an autoradiogram, when viewed under the light microscope shows the cellular structures and the location of the isotope

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with a resolution of less than $1\ \mu\text{m}$. In this way, the distribution of tritium-labeled deoxyribonucleic acid (DNA) of individual chromosomes was traced through two to three cell divisions. These studies were made possible by the preparation of tritiated thymidine which is a highly selective label for DNA and is quickly depleted when the cell is removed from the environment containing the labeled thymidine. The technique yielded information on the mechanism of DNA replication, structure and reproduction of chromosomes, kinetics of cell division, and, more recently, on the patterns and time sequence in the reproduction of different chromosomes in the same nucleus and the different parts of a single chromosome. All chromosomes studied so far contain two functional sub-units of DNA which are distributed in a semi-conservative fashion during reproduction. The two sub-units are unlike in some structural sense that limits the type of exchanges that may occur among the four sub-units of a reproducing chromosome. Present evidence on sequences leads to the hypothesis that chromosomes reproduce in a genetically controlled sequence. Further evidence on the patterns and mechanism of control of the sequence are being sought along with other related processes that involve the synthesis of chromosomal proteins and the other class of nucleic acids, ribonucleic acids.

283 COMPARISON OF EFFECTS OF ATOM DECAY AND BETA-RAY RADIATIONS ON THE INACTIVATION AND MUTATION OF A MYCOBACTERIUM. Michio Tsukamura (Obuso National Sanatorium, Obu, Japan). *Genetics*, 46: 1561-4 (Dec. 1961).

The effects of P^{32} and Sr^{90} added to culture media were compared in a Mycobacterium to determine whether decay of atoms or intracellular beta radiations takes an important role in causing inactivation and mutation. Both inactivation and mutation occurred significantly in a culture grown in medium containing $1\ \mu\text{C}\ \text{P}^{32}/\text{ml}$, and only a moderate increase of mutations occurred without inactivation of cells in a culture grown in medium containing $20\ \mu\text{C}\ \text{Sr}^{90}/\text{ml}$. No significant increase of mutation was seen in a culture grown in medium containing $2\ \mu\text{C}\ \text{Sr}^{90}/\text{ml}$. Since large amounts of intracellular and extracellular beta radiations from Sr^{90} were found to be ineffective in causing inactivation of cells and much less effective in causing mutation than is true for a small amount of P^{32} , it is conceivable that inactivation and mutations occurring in cells grown in medium containing such a small amount of P^{32} ($1\ \mu\text{C}\ \text{P}^{32}/\text{ml}$) are due neither to intracellular nor extracellular beta-ray radiations but mostly to decay of P^{32} atoms incorporated into cells.

284 INACTIVATION AND MUTATIONS IN MYCOBACTERIUM AVIUM BY DECAY OF INCORPORATED RADIOACTIVE PHOSPHORUS. Michio Tsukamura (Obuso National Sanatorium, Obu, Japan). *Genetics*, 46: 911-24 (Aug. 1961).

Inactivation and mutation occurred in Mycobacterium Jucho by decay of incorporated radioactive phosphorus (P^{32}) under the conditions in which cells labeled with P^{32} were stored in freezing state during the progress of P^{32} decay, and the existence of any selective process of marker mutants could be excluded. Relationships between the inactivation and mutations and the intracellular distribution of P^{32} were studied. Fractionation of radioactive cells was also performed. Inactivation of cells was much more markedly affected by the amount of P^{32} in the DNA fraction

than by the amount of total radioactivity of cells that parallels the amount of beta-ray irradiation. Inactivation curves, survival curves plotted as a function of the amount of P^{32} decay, tended to be exponential, if the DNA fraction was labeled heavily by P^{32} . It is suggested that beta-ray irradiation is not responsible for inactivation of bacterial cells and decay of P^{32} in the DNA fraction, but that change of P^{32} into S^{32} in DNA structure is mainly responsible for it. If cells were labeled by P^{32} representing a relatively low content of P^{32} in the DNA fraction, inactivation of cells occurred showing decay-survival curves of a multihit type. Thus, it is also suggested that inactivation of cells may occur also by decay of P^{32} in multiloci outside of the DNA. Mutation frequency to isoniazid resistance was rapidly increased with progress of P^{32} decay, while mutation frequency to streptomycin resistance was not increased or only slightly increased. Thus, a marked discrepancy between these two mutations was observed. Mechanism of this discrepancy was discussed. The incidence of mutation (to isoniazid resistance) did not parallel the amount of total radioactivity of cells that corresponded to the amount of beta-ray irradiation. The induced mutation was increased roughly in accordance with the progress of P^{32} decay. It is conceivable that the induced mutation also occurs by decay of incorporated P^{32} .

285 MUTAGENIC EFFECT OF CONTINUOUS IRRADIATION BY PHOSPHORUS-32 OF MYCOBACTERIUM AVIUM AND INFLUENCES OF STREPTOMYCIN AND SULFATHIAZOLE ON THIS EFFECT. Michio Tsukamura, Takashi Abo, and Rokuro Katsumura. (Obuso Natl. Sanatorium, Obu, Aichi-ken). *Nippon Saikingaku Zasshi* 12, 853-6 (1957). CA-53: 3365f.

286 ON THE PHYSIOLOGICAL AND MUTAGENIC ACTION OF D2-O ON DROSOPHILA MELANOGASTER. V. G. Tumanian and S. E. Shnol'. *Biofizika* 8, 15-8 (1963)

287 CHROMOSOME BREAKAGE PRODUCED BY TRITIUM-LABELED THYMIDINE IN TRADESCANTIA PALUDOSA. Donald E. Wimber (Brookhaven National Lab., Upton, N. Y.). *Proc. Natl. Acad. Sci. U. S. A.* 45, 839-46 (1959) June.

The fragmentation of chromosomes in the root tips of *Tradescantia paludosa* as produced by tritium-labeled thymidine was measured. As many as 31 fragments per 100 cells occurred in roots grown for 4 to 8 hours in 1 or $2\ \mu\text{C}/\text{ml}\ \text{H}^3$ -thymidine and then transferred to isotope-free solutions for further growth before collection. The highest fragment frequency could be correlated with the period during which the maximum amount of H^3 -thymidine was incorporated into the chromosomes. Up to 72 fragments per 100 cells at anaphase were demonstrated after continuous exposure of root tips to $1\ \mu\text{C}/\text{ml}\ \text{H}^3$ -thymidine for times up to 56 hours. The mitotic index dropped sharply in roots that had been exposed to $1\ \mu\text{C}/\text{ml}\ \text{H}^3$ -thymidine for periods over 8 hours. Cells that absorb large quantities of H^3 -thymidine as indicated by autoradiographs are seemingly disturbed in their development and are delayed or prevented from entering mitosis. Autoradiographs of roots that had been exposed to $1\ \mu\text{C}/\text{ml}\ \text{H}^3$ -thymidine for 24 to 56 hours showed that the average grain count over dividing nuclei increased as the fragmentation appearing at anaphase

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increased. Approximations of the dose delivered to the nuclei by the endogenous radiation from the tritium were made by two different methods; however, the estimates showed poor agreement. Confident calculations of the dose probably await the determinations of the efficiency of the β rays in producing an autoradiograph. These findings would indicate that investigators utilizing tritiated substances should interpret their results with caution for the endogenous radiation delivered to a cell may be great enough to cause considerable chromosome breakage and presumably other forms of genetic damage as well as significant changes in cellular physiology.

IMMUNOLOGY

288

IMMUNIZATION AFTER INTRAVENOUS INJECTION OF SMALL AMOUNTS OF Cr-51 LABELLED RED CELLS. P. L. Adner, S. Foconi, and S. Sjölin. *Brit. J. Haemat.* **9**, 288-98(1963) July

289

FORMATION OF SPECIFIC ANTIBODIES AND γ -GLOBULIN IN VITRO. A STUDY OF THE SYNTHETIC ABILITY OF VARIOUS TISSUES FROM RABBITS IMMUNIZED BY DIFFERENT METHODS. Brigitte A. Askonas and J. H. Humphrey. (Nat'l. Inst. Med. Research, London). *Biochem. J.* **68**, 252-61 (1958). CA-52: 9370a.

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THE EFFECTS OF X-IRRADIATION ON THE PREVENTIVE ACTIVITY OF THE HOST AGAINST BACTERIAL INFECTION. III. INACTIVATION IN THE RETICULO-ENDOTHELIAL SYSTEM BY X-IRRADIATION AND THE EFFECT OF RADIOISOTOPE PHOSPHORUS-32. Shigemitsu Awataguchi (Tokyo Univ. School Med.). *Nippon Saikingaku Zasshi* **13**, 398-402(1958). CA 53-18118f

291

IN VIVO PURIFICATION OF IODINE-131-LABELLED LOCALIZING ANTIRAT LYMPHOSARCOMA ANTIBODY. Wm. F. Bale, Irving L. Spar, and Ruth L. Goodland. (Univ. of Rochester, Rochester, N. Y.). *J. Immunol.* **80**, 482-94(1958). CA-52: 15712h.

292

PREPARATION AND PURIFICATION OF HUMAN INSULIN- I^{131} ; BINDING TO HUMAN INSULIN-BINDING ANTIBODIES. Solomon A. Berson and Rosalyn S. Yalow (Veterans Administration Hospital, Bronx, N. Y.). *J. Clin. Invest.*, **40**: 1803-8(Oct. 1961).

The preparation of I^{131} -labeled human insulin from a lot of human insulin containing approximately 25% insulin by weight and its purification from labeled contaminants are described. The reaction of human insulin- I^{131} with insulin-binding antibodies in the serums of human subjects treated with commercial mixtures of animal insulins is demonstrated directly. Comparison of the binding of human insulin and beef insulin in antisera from eight insulin-resistant and nonresistant diabetic subjects revealed a lesser affinity of antibody for human than for beef insulin in most cases, but considerable variability in this respect was encountered among different antisera.

293

THE DEVELOPMENT OF ANTIBODIES IN WHITE RATS IMMUNIZED AGAINST INFLUENZA, UNDER THE INFLUENCE OF RADIATIONS EMITTED BY IODINE-131 AND PHOSPHORUS-32. O. Burducea, M. Cepleanu, and R. Caprarur. *Stud. Cercet. Inframicrobiol.* **12**, 137-42(1961)

294

THE ELECTROPHORETIC STUDY OF SERA FROM ANTI-INFLUENZA IMMUNIZED RATS TREATED WITH RADIO-PHOSPHORUS (P-32) AND RADIOIODINE (I-131). O. Burducea, I. Samuel, and M. Cepleanu. *Stud. Cercet. Inframicrobiol.* **13**, 89-96(1962)

295

CONTRIBUTION TO THE KNOWLEDGE OF THE ANTI-THYROID ACTIVITY OF SOME SUBSTANCES WITH ANTITUBERCULAR ACTIVITY. RESEARCH WITH RADIOIODINE. P. Carenza and A. Girolami. *Arch. Tisiol.* **14**, 1218-30(1959) Dec.

296

THE RELATIVE BINDING OF CALCIUM AND STRONTIUM WITH SERUM PROTEINS AND OTHER SUBSTANCES. Charles W. Carr, Leon Singer, and Francis A. Spurrell (Univ. of Minnesota Medical School, Minneapolis and Univ. of Minnesota, St. Paul). *Proc. Soc. Exptl. Biol. Med.*, **110**: 80-3(May 1962).

Sera from various mammalian species, solutions of various fractions of serum proteins, and solutions of certain other substances were tested by ultrafiltration in the presence of Ca^{45} and Sr^{85} for their binding of Ca, and Sr. For 6 species, human, dog, horse, cow, sheep, and rat, the ratio, Ca bound/Sr bound, was 1.29, 1.14, 1.19, 1.15, 1.17, and 1.13, respectively. The absolute degree of binding shown by these species falls into 2 groups. The human, dog, and horse sera bound the 2 ions to a lesser extent, 57% Ca and 47% Sr; cow, sheep, and rat sera bound the ions to a greater extent, 69% Ca and 60% Sr. Ultrafiltration of various serum protein fractions of the human and bovine revealed that fraction V (albumin) showed no difference between the binding of Ca and Sr but differences were noted with the globulin fractions (IV, III, II) that could account for the discrimination observed in whole serum. Results of the ultrafiltration of a variety of other proteins and polyelectrolytes led to the speculation that mucoproteins in the serum globulins could account for the large fluctuations in binding of both ions by globulin fractions of various species; however, the results did not show any indication of the type of substance or chemical grouping which could account for the slight but persistent discrimination between Ca and Sr that has been observed in whole serum.

297

RESEARCH ON THE EFFECT OF STERILIZING DOSES OF COBALT-60 GAMMA RAYS ON ANTIBACTERIAL SERA. O. V. Chakhava. *J. Hyg. Epidem. (Praha)* **4**, 196-206(1960)

298

EXPERIMENTAL STUDIES ON THE EFFECT OF AUTO-ANTIBODIES AGAINST X-RAY IRRADIATED LUNG TISSUE UPON TISSUE RESPIRATION AND THE TISSUE ATP-SYSTEM (P^{32} -INCORPORATION) OF LUNG. S. Chiba (Iwate Medical Coll., Morioka, Japan). *Nippon Igaku Hoshasen Gakkai Zasshi*, **20**: 1448-75(1960).

Tissue respiration of the irradiated right lung of rabbits was inhibited to a degree which was parallel to the magnitude of the dose from 2000 to 50 r. The non-irradiated left lung, however, also showed similar changes. This was

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considered to be caused by auto-antibodies produced in large quantities. A decrease of ATP and increase of ADP in the tissues of the irradiated lung were observed. These findings were also seen in the non-irradiated lung of rabbits. Considerable inhibition of incorporation of P^{32} of the ATP-system was noted both in the irradiated and the non-irradiated lung of rabbits. It is postulated that auto-antibodies which were produced by x-irradiation of the lung had a definite inhibitory action of the lung. (Abstr. Japan Med., 2, No. 2, Feb. 1962).

299

RESEARCH ON THE IMMUNOLOGICAL STATE OF GUINEA PIGS PREVACCINATED WITH BCG OR PREINFECTED WITH H37Rv AT VARIOUS PERIODS OF TIME. (EXPERIMENTAL RESEARCH WITH TUBERCLE BACILLI "LABELED" WITH RADIOPHOSPHORUS). G. Curci and A. Ninni. *Arch. Tisiol.* 17, 469-80 (1962) June. (It)

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IMMUNOCHEMICAL STUDY OF IODINE-131 LABELED SPUTUM PROTEINS: ELECTROPHORETIC, AUTORADIOGRAPHICAL AND IMMUNOLOGICAL RESEARCH. A. D'Addabbo. *Minerva Nucl.* 6, 301-10 (1962) Oct.

301

THE RELATION OF THE RATES OF SERUM PROTEIN METABOLISM, HETEROLOGOUS SERUM PROTEIN CATABOLISM, AND THE TIME AND MAGNITUDE OF THE ANTIBODY RESPONSE. Frank J. Dixon and Wm. O. Weigle. (Univ. of Pittsburgh, Pittsburgh, Pa.). *Ann. N.Y. Acad. Sci.* 70, 69-71 (1957). CA-52-3984h.

302 (JPRS-5761(p.189-91)) THE COURSE OF EXPERIMENTAL TUBERCULOSIS UNDER CONDITIONS OF THE EFFECT OF RADIOACTIVE PHOSPHORUS. E. D. Dubovyi (Ye. D. Duboy), L. B. Aksel'rod, N. D. Golban, A. A. Konshin, and E. P. Tsyban. Translated from *Med. Radiol.* 5, No. 7, 71 (1960).

The immunological mechanisms in animals infected with tuberculosis were found to be greatly reduced after the administration of large doses of P^{32} . The administration of small doses of P^{32} caused a more favorable course of tuberculosis than that observed in controls.

303

IMMUNOLOGICAL STUDIES WITH I-131-LABELED ANTIGEN IN EXPERIMENTAL UVEITIS. *AMA Arch. Ophthal.* 63, 515-39 (1960) March

304 IODINE-125 AS A PROTEIN LABEL IN IMMUNOLOGY. Frank W. Fitch, James Winebright, and Paul V. Harper (Argonne Cancer Research Hospital, Chicago). *Science*, 135: 1068-9 (Mar. 23, 1962).

Advantages of using I^{125} as a protein label in immunology are given. The 60-day half-life provides long shelf life for labeled materials, and the low energy dissipation rate, approximately 15% that of I^{131} , greatly reduces radiation damage to tagged compounds. Formalin-killed *Salmonella typhosa* bacilli were iodinated with I^{125} and injected intravenously into rats. Tissues sampled for measurement of radioactivity and for autoradiography showed an average of 77% of the injected radioactivity was present in the liver and 2.5% in the spleen.

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THE USE OF RADIOACTIVE ISOTOPES IN IMMUNOLOGICAL INVESTIGATIONS. THE ROLE OF LEUCOCYTES AND NON-PLASMA ANTIBODY IN THE REMOVAL OF ANTIGENIC PROTEINS FROM THE BLOOD STREAM OF IMMUNIZED RABBITS. G. E. Francis and J. D. Hawkins (St. Bartholomew's Hospital, London). *Biochem. J.* (London) 69, 287-97 (1958) June.

Bovine plasma albumin and horse serum labeled with iodine-131 were employed in studies on the behavior and elimination of intravenously injected native proteins in normal and immune rabbits. Actively, but not passively, immunized rabbits can eliminate rapidly from their blood more antigen than their sera can precipitate *in vitro*, except when they have been in the immune state for a long time. When immune rabbits are given an injection of antigen sufficient to react with all the antibody in their plasma, a second small injection of antigen is eliminated from the blood more rapidly than a similar dose injected into normal rabbits. There is evidence for deposition of part of the second injected dose in the liver, lungs, and spleen of the immune rabbits. The significance of these observations is discussed and it is concluded that some non-plasma antibody is partly responsible for the immune responses observed when an antigen is injected into specifically immunized rabbits. This non-plasma antibody is unlikely to be mainly in the lymphocytes or lymphoid tissue. Injection of antigen into immune, but not into normal, rabbits causes a profound leucopenia, which is due to a fall in the numbers of both lymphocytes and granulocytes. This phenomenon is not modified by the prior injection of cortisone in amounts sufficient to cause a lymphocytopenia.

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PRECIPITATION OF RADIOLABELED POLIOVIRUS WITH SPECIFIC ANTIBODY AND ANTIGLOBULIN. R. K. Gerloff, B. H. Hoyer, and L. C. McLaren. *J. Immun.* 89, 559-70 (1962) Oct.

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A GENERAL METHOD FOR THE QUANTITATION OF IMMUNE CYTOLYSIS. Harold S. Goodman (Univ. of Chicago). *Nature*, 190: 269-70 (Apr. 15, 1961).

A test using Cr^{51} -labeled cells was developed for quantitative measurements of immune lysis for cells derived from a variety of tissues. Procedures are described and data are tabulated from typical measurements of antibody cytolytic activity in tumor cells

308

THE BEHAVIOR OF RADIOACTIVE-LABELLED ANTIGENS TOWARD BLOOD ERYTHROCYTE ELEMENTS. V. DETERMINATION OF THE SURVIVAL TIME OF HOMOLOGOUS ERYTHROCYTES AFTER IN VITRO LOADING WITH S-35-LABELLED ALCOHOL DEHYDROGENASE AND Cr^{51} -LABELLED POLYSACCHARIDES. F. Gramlich, J. Fischer and D. Mohring. *Klin. Wschr.* 40, 955-9 (1962) Sept.

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EFFECT OF IMMUNIZATION WITH TWO ANTIGENS ON ANTIBODY CONTENT AND RATE OF GLYCINE- C^{14} INCLUSION INTO ANTIBODIES. A. E. Gurvich and N. P. Smirnova. *Biochemistry (U.S.S.R.)* 22, 584-92 (1957) (English translation). CA-52: 13964f.

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THE EFFECT OF IMMUNIZATION WITH TWO ANTIGENS

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- 311** USE OF RADIOISOTOPES IN IMMUNOCHEMICAL RESEARCH. Felix Haurowitz (Indiana Univ., Bloomington). 26p. of "Ergebnisse der Mikrobiologie Immunitätsforschung und Experimentellen Therapie." Berlin, Springer-Verlag, 1961. (In English)
Discussion is given on the preparation of isotopically labeled antigens, antibodies, and complement components; elimination of isotopically labeled antigens from the circulation; distribution and deposition of labeled antigens; metabolism of labeled antigens in sensitized animals; use of isotopically labeled antigens for the detection and determination of antibodies; use of labeled antibodies in immunological research; formation of isotopically labeled antibodies and their metabolism; determination of the half life and the breakdown of isotopically labeled antibodies; and investigations on isotopically labeled complements. 141 references are given.
- 312** USE OF C^{14} -AMINO ACIDS TO STUDY SITES AND RATES OF ANTIBODY SYNTHESIS IN LIVING HYPERIMMUNE RABBITS. J. H. Humphrey and B. D. Sulitzeanu. (Natl. Inst. Med. Research, London). Biochem. J. 68, 146-61(1958). CA-52: 7484h.
- 313** EFFECT OF MOLECULAR WEIGHT ON UPTAKE OF ANTIGENS BY IMMUNOLOGIC AGGREGATES. R. E. Kahn, S. Leskowitz, and F. C. Lowell. J. Immun. 89, 874-80(1962) Dec.
- 314** CELLULAR IMMUNITY CHANGES IN CHRONIC CONTINUOUS ACTIVITY OF IONIZING RADIATIONS. P. N. Kiselev and P. A. Buzini. Med. Radiol. (Moskva) 7, 59-65(1962) Aug.
- 315** INFLUENCE OF CONTINUOUS AND PERMANENT EXPOSURE TO SMALL DOSES OF IONIZING RADIATION ON HUMORAL AND CELLULAR IMMUNITY. P. N. Kiselev and P. A. Buzini. Radiobiol. Radiother. 1, 189-96(1960) Oct.-Nov.
- 316** CHARACTERIZATION OF COMPLEXES WHICH CONTAIN DIPHTHERIA TOXIN AND HUMAN NON-PRECIIPITATING ANTITOXIN. W. J. Kuhns, S. P. Masouredis, and L. Swabey (Univ. of Pittsburgh, Pittsburgh, Pa.). J. Immunol. 82, 226-31(1959). CA 53-11596b
- 317** BEHAVIOR OF INTRAVENOUSLY ADMINISTERED DIPHTHERIA TOXIN- I^{131} IN THE GUINEA PIG. S. P. Masouredis (Univ. of Pittsburgh, Pittsburgh, Pa.). J. Immunol. 82, 319-27(1959). CA 53-15335g
- 318** TOXICITY AND IMMUNOCHEMICAL PROPERTIES OF IODINE-131 LABELED DIPHTHERIA TOXIN. S. P. Masouredis. (Univ. of Pittsburgh, Pittsburgh, Pa.). J. Immunol. 79, 516-24(1957). CA-52: 7418g.
- 319** A SIMPLIFIED METHOD FOR IMMUNO-ASSAY OF HUMAN SERUM INSULIN. R. C. Meade and H. M. Klitgaard. J. Nucl. Med. 3, 407-16(1962) Sep.
- 320** IN VITRO UPTAKE OF ANTIGEN-ANTIBODY COMPLEXES BY PHAGOCYtic CELLS. R. Patterson, I. M. Suszko and J. J. Pruzansky. J. Immun. 89, 471-82(1962) Oct.
- 321** EFFECTS OF WHOLE-BODY Co^{60} IRRADIATION ON THE ELIMINATION OF AN I^{131} -LABELED ANTIGEN. I. STUDY OF THE SENSITIZATION PHENOMENON. F. Piccotti, G. L. Sannazzari, and A. Torretta (Università, Turin). Minerva Fisioterap., 7: 312-20(Nov.-Dec. 1962). (In Italian)
Adult rabbits were sensitized by intradermal injection of 10 μ g human serum albumin (HSA), and in some cases exposed 12 hr later to 500-r γ radiation. In other animals irradiation preceded injection of antigen by 12 hr, some received radiation only, and others no treatment. Eight days later I^{131} -labeled HSA was injected intravenously and its rate of elimination from the circulation followed by serial assays of blood radioactivity. In rabbits receiving no treatments, HSA- I^{131} in blood fell to 14% of the initial level and then, at a more rapid rate, to 0.2% by the 7th day. Faster (immune) elimination of antigen was noted in the sensitized rabbits, only 1.2 and 0.14% remaining by the 4th and 5th days. Elimination of antigen was considerably slowed in rabbits receiving irradiation alone, with 18% remaining on the 4th and 0.14% on the 10th day, showing the inhibitory effect of irradiation on the nonimmune mechanisms for removing foreign protein from the circulation. Rabbits irradiated 12 hr after sensitization cleared the antigen from the blood much faster (0.8 and 0.2% remaining at 4 and 5 days) than those irradiated before (12 and 6% at 4 and 5 days) and slightly faster than sensitized but nonirradiated rabbits. The results indicate that antibody is rapidly synthesized after introduction of antigen and that midlethal irradiation 12 hr later does not impair the immune mechanisms for removal of the antigen from the circulation when it is reintroduced 8 days later. In contrast, irradiation before sensitization abolishes the immune mechanism for elimination of antigen.
- 322** A COMPARISON OF FLUORESCCEIN AND IODINE-131 AS LABELS FOR DETERMINING THE IN VIVO LOCALIZATION OF ANTITISSUE ANTIBODIES. David Pressman, Yasuo Yagi, and Raymond Hiramoto (Roswell Park Mem. Inst., Buffalo, N. Y.). Intern. Arch. Allergy Appl. Immunol. 12, 125-36(1958). CA 53-8257i
- 323** CONTINUOUS COBALT-60 IRRADIATION AND IMMUNITY TO INFLUENZA VIRUS. J. J. Quilligan, Jr., et al. J. Immun. 90, 506-11(1963) Apr.
- 324** LABELING OF ANTIBODY AGAINST THE EHRLICH MOUSE ASCITES CARCINOMA WITH TRITIUM (H^3). P. C. Rajam and A. L. Jackson. J. Lab. Clin. Med. 55, 46-54(1960) Jan.
- 325** THE EFFECT OF RADIOACTIVE PHOSPHORUS ON THE PROCESSES OF INFECTIVITY AND IMMUNITY. II. THE FORMATION OF TYPHOID AGGLUTININS IN RABBITS EXPOSED TO THE EFFECT OF RADIOACTIVE PHOSPHORUS.

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THE BEHAVIOR OF TRACE-LABELLED ANTIGEN IN PAPER ELECTROPHORESIS IN THE PRESENCE OF ANTISERA. Jim Rhodes, E. Sorkin. *Scand. J. Clin. Lab. Invest.* 12, 38-46(1960)

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A COMPARISON OF THE EFFECTS OF RADIOACTIVE INTERNAL EMITTERS AND X-RAYS ON ANTIBODY FORMATION. Paul R. Salerno and Hymer L. Friedell. (Western Reserve Univ. School Med., Cleveland, O.). *Radiation Research* 9, 478-86(1958). CA-53:7387h.

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USE OF RADIOACTIVE ISOTOPES IN EXPERIMENTAL IMMUNOLOGY. Miroslav Simić. *Primena Radioaktiv. Izotopa i Jonizujucih Zracenja u Med.*, 2: No. 3, 25-32(Dec. 1961). (In Yugoslavian)

The use of radioactive isotopes has provided a great stimulus for research in the field of experimental immunology. Radioactive tracer techniques have been employed in virtually all branches of immunological investigation. New possibilities of investigation offered by the use of radioactive isotopes on the fate of antigens *in vivo*: the properties, synthesis, and degradation of antibody molecule; and the use of labeled antibody in cancer research are reviewed. In all three of these areas much new knowledge has been gained through the use of tracer techniques.

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A/CONF.15/P/2124
MEKHAZIM ANTIBAKTERIAL'NOGO DEISTVIYA 6-AZURATSILA-4,5-C¹⁴. (Mechanism of the Antibacterial Action of 6-Azuracil-4,5-¹⁴C.) J. Škoda and F. Šorm (Czechoslovakia). 6p.

6-Azuracil-C¹⁴ is converted into 6-azauracil riboside-C¹⁴ by growing cultures of *E. coli*; this microbiological reaction was used to prepare relatively large amounts of the carcinostatic 6-azauracil riboside. The formation of 6-azauracil riboside is accompanied by an accumulation in the medium of orotic acid, free uracil, and hypoxanthine. 6-Azuracil is not metabolized in a cell-free extract of *E. coli* even in the presence of adenosine triphosphate and ribose-5-phosphate. However, the same cell-free extract gives rise to considerable amounts of radioactive nucleotide from 6-azauracil riboside-C¹⁴ and adenosine triphosphate. The presence of uracil riboside inhibits the formation of 6-azauracil riboside-5'-phosphate. In the absence of adenosine triphosphate not even trace amounts of 6-azauracil riboside-5'-phosphate are formed.

330

IN VIVO LOCALIZATION STUDIES OF IODINE-131-LABELED ANTI-MURPHY-STURM LYMPHOSARCOMA ANTIBODIES. Irving L. Spar, William F. Bale, and Ruth L. Goodland. (Univ. of Rochester, Rochester, N. Y.). *U. S. At. Energy Comm. UR-525*, 23(1958). CA-53:4508e.

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PREPARATION AND HUMAN TRACER STUDIES WITH

IODINE-131 LABELED ANTIBODY REACTING WITH FIBRIN. I. L. Spar, W. F. Bale, R. L. Goodland and M. J. Izzo. *U. S. Atom. Energy Comm. Univ. Rochester* 614, 33(1962) Aug.

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PREPARATION OF PURIFIED IODINE-131 LABELED ANTISERA TO HUMAN FIBRINOGEN. PRELIMINARY STUDIES IN TUMOR PATIENTS. I. L. Spar, W. F. Bale, R. L. Goodland and G. Di Chiro. *Acta Un. Int. Cancr.* 19, 197-200(1963)

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LOCALIZATION PROPERTIES OF RADIOIODINATED FRAGMENTS OF ANTIRAT KIDNEY ANTIBODY: P. Stelos, Y. Yagi, and D. Pressman. *J. Immunol.* 87, 106-9(1961) July

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IN VITRO PRODUCTION OF DIPHTHERIA ANTITOXIN BY TISSUES OF IMMUNIZED ANIMALS. II. DEVELOPMENT OF A SYNTHETIC MEDIUM WHICH PROMOTES ANTIBODY SYNTHESIS AND THE INCORPORATION OF RADIOACTIVE AMINO ACIDS INTO ANTIBODY. Benjamin Wolf and Abram B. Stavitsky. (Western Reserve Univ., Cleveland, O.). *J. Immunol.* 81, 404-13(1958). CA-53:3445c.

MICROBIOLOGY

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STUDIES OF PHOSPHOPROTEIN FUNCTIONS. II. THE EFFECT OF SOME GLYCOLYTIC INHIBITORS ON THE INCORPORATION RATE OF PHOSPHORUS-32 INTO TRICHLOROACETIC ACID-SOLUBLE NUCLEOTIDES AND PROTEIN PHOSPHORYLSERINE OF BAKERS' YEAST. Gunnar Agren. (Univ. Uppsala, Swed.). *Acta Soc. Med. Upsaliensis* 63, 137-48(1958). CA-53:6306f.

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EFFECT OF SEASONS ON THE SENSITIVITY TO ANTIBIOTICS OF THE INTESTINAL MICROFLORA IN THE DOG UNDER CHRONIC INFLUENCE OF STRONTIUM-90. O. G. Alekseeva and G. M. L'vitsina. *Med. Radiol. (Moskva)* 7, 58-61 (1962) Mar.

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A RAPID ASSAY METHOD FOR TRITIUM IN BACTERIAL CELLS. E. L. Alpen and H. G. Mandel. *Biochim. Biophys. Acta* 43, 317-21(1960) Sept.

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A/CONF.15/P/990
THE INFLUENCE OF POTASSIUM AND SODIUM ON THE METABOLISM OF METHIONINE IN YEASTS (INVESTIGATED WITH S³⁵). F. Alten and O. Werk (Landwirtschaftliche Forschungsanstalt Bünthof, Hanover). 5p.

The influence of potassium and sodium on the metabolism of methionine in yeast was studied. Sulfur-35 was added to suspensions of potassium-exhausted yeasts. The effects of sodium and potassium on the uptake of sulfur and the formation of methionine were measured. Data are tabulated and discussed.

339 IN VIVO INVESTIGATION OF THE REMOVAL OF TRACE ELEMENTS FROM NUCLEIC ACIDS OF YEAST BY IONIZING RADIATION. Hans Altmann,

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Gerhard Stehlik, and Karl Kaindl (Inst. of Biology and Agriculture, Reactor Center, Seibersdorf, Austria). *Nature*, 199: 823(Aug. 24, 1963).

Neutron activation analysis was used to measure the content of certain trace elements in yeast nucleic acids before and after exposure to various doses of Co^{60} γ radiation ranging from 0 to 24,000 rads. Data are presented for Cu, Mn, Ni, and Zn. A decrease of the trace element content at doses above 8000 rads was observed. Possible reaction mechanisms involved are discussed.

340 STUDIES ON THE RESISTANCE TO γ -IRRADIATION OF Co^{60} IN *ESCH. COLI* B. T. Aoyama (Kobe Medical Coll., Japan). *Nippon Igaku Hoshasen Gakkai Zasshi*. 20: 505-20(1960).

A strain of *Esch. coli* B, resistant to Co^{60} γ irradiation, was isolated from the original strain by means of the training method. The resistance continued to be stable on subculture for 1.5 yr. This strain survived even after exposure to 115 and 200 r, which was three times the MLD of the original strain. Morphologically, the cell size of this strain was smaller than the original as observed microscopically and by electron microscope measurement. With regard to the fermentation of sugar and the other usual biological characteristics, no difference was detected between the resistant and the original strain. (Abstr. Japan Med. 1: No. 12, 1961).

341 THE INACTIVATION OF *ESCHERICHIA COLI* BACTERIA LABELLED WITH TRITIATED THYMIDINE. Sonia Apelgot (Institut du Radium, Paris). p.167-78 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

Bacteria of the strain $\text{B}_1^3 \text{thy}^-/\text{Sr}$, which required thymine and are streptomycin-resistant, had their DNA labeled with tritiated thymidine. The radioactivity measurements were made with a liquid scintillation counting system, with two photomultipliers mounted in coincidence. Under these conditions, the efficiency of the measures was 4.5% and the background 130 counts/min. The radioactive bacteria were kept in sealed tubes either at 0°C or at -196°C and their survival studied. These experiments showed that the radioactive bacteria are inactivated exponentially as a function of the number of tritium atoms disintegrated. The inactivation is temperature dependent. In both cases the killing efficiency per nuclear transmutation was determined and found as very low. The number of ion pairs generated by the β particles emitted as a consequence of the transmutation of H^3 was evaluated and found quite comparable with the one found in the case of x rays. The suicide caused by the H^3 disintegrations seems to be directly linked with the ionizations produced by the β particles inside the bacterial DNA.

342 LABELLING OF A BACTERIAL DESOXYRIBONUCLEIC ACID BY RADIOPHOSPHORUS, RADIOCARBON AND TRITIUM: COMPARISON OF THE LETHAL EFFECTS. S. Apelgot and R. Latarjet. *Biochim. Biophys. Acta* 55, 40-55(1962) Jan. 22

343 STUDIES AND EXPERIMENTS IN RADIOMICROBIOLOGY. ASSIMILATION OF Fe^{59} , I^{131} , P^{32} , AND S^{35} BY *STAPHYLOCOCCUS ENTEROTOXICUS*. C. Arghittu (C.A.M.E.N., Livorno, Italy). *Minerva Nucleare*, 4: 313-15(Nov. 1960). (In Italian)

The value of radioisotopic techniques in the field of microbiology was illustrated, and the technique was used to determine the radioactive uptake by *staphylococcus enterotoxicus* in the presence of Fe^{59} , I^{131} , P^{32} , and S^{35} was described. The uptakes of I^{131} , P^{32} , and S^{35} by this organism were very low (1.8, 4.4, and 2.5%, respectively); whereas the uptake of Fe^{59} was considerable (31.8%). This finding is important as regards the choice of radioisotopes for labeling *staphylococcus enterotoxicus* and its toxin (enterotoxin).

344 STUDIES AND EXPERIMENTS IN RADIOMICROBIOLOGY. II. DISTRIBUTION OF *STAPHYLOCOCCUS ENTEROTOXICUS* LABELED WITH Fe^{59} IN GUINEA PIGS INOCULATED BY INTRAPERITONEAL ROUTE AND CONCENTRATIONS OF THE RADIOELEMENTS IN THE GASTROENTERIC SYSTEM. C. Arghittu and B. D. Prandini. *Minerva Nucl.* 6, 58-62(1962) Feb.

345 DISTRIBUTION OF MYCOBACTERIA TUBERCULOSIS LABELLED WITH RADIOACTIVE PHOSPHORUS IN THE BODY OF THE GUINEA PIG FOLLOWING INTRAVENOUS INOCULATION. O. P. Arkhipova and O. A. Uvarova. *Probl. Tuberk.* 40(2), 74-83(1962)

346 DYNAMICS OF DISTRIBUTION OF P^{32} LABELED MYCOBACTERIA TUBERCULOSIS IN VACCINATED AND NON-VACCINATED GUINEA PIGS AFTER SUBCUTANEOUS INJECTION. O. P. Arkhipova and O. A. Uvarova. *Probl. Tuberk.* 38, (2), 53-65(1960)

347 METABOLISM OF VIRUS-INFECTED TISSUES. II. EFFECT OF INFLUENZA VIRUS ON RIBONUCLEOTIDE METABOLISM IN CHICK CHORIOALLANTOIC MEMBRANES. Harold Arnoff and Max E. Rafelson, Jr. (Univ. of Illinois Coll. of Med., Chicago). *Arch. Biochem. Biophys.* 81, 421-9(1959). CA 53-14297a

348 EFFECTS OF CHLORAMPHENICOL ON RIBONUCLEIC ACID METABOLISM IN T_2 -INFECTED *ESCHERICHIA COLI*. L. Astrachan and E. Volkin (Oak Ridge Natl. Lab., Oak Ridge, Tenn.). *Biochim. et Biophys. Acta* 32, 449-56(1959) (in English). CA 53-15201i

349 EFFECT OF ENZYMATIC INDUCTION ON THE RATE OF SYNTHESIS OF A SPECIFIC MESSENGER RNA IN *E. COLI*. G. Attardi, S. Naono, F. Gros, S. Brenner, and F. Jacob. *C. R. Acad. Sci. (Paris)* 255, 2303-5(1962) Oct. 29. (Fr)

350 BIOPHYSICAL STUDY OF PHAGE DEOXYRIBONUCLEIC ACID BY MEANS OF MOLECULAR AUTORADIOGRAPHY. S. Aurisicchio, G. Cortini, V. Emma, and F. Graziosi (Univ. Catania, Italy). *Intern. J. Radiation Biol.* 1, 86-90(1959) (in English). CA 53-14161g

351 BIOSYNTHESIS OF RIBOSE AND DEOXYRIBOSE IN *ESCHERICHIA COLI*. Fillmore K. Bagatell, Elmer M. Wright, and Henry Z. Sable (Western Reserve Univ., Cleveland, O.). *J. Biol. Chem.* 234, 1369-74(1959). CA 53-17238a

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CHEMICAL TOXICITY OF PLUTONIUM IN YEAST.
W. J. Bair and F. P. Hungate. Dec. 3, 1958. 14p.
Contract W-31-109-Eng-52. \$0.50(OTS).
Tentative evidence for chemical toxicity effects of Pu²³⁹ on yeast is presented. Inhibition of glucose uptake and respiration in *Saccharomyces cerevisiae* exposed to Pu²³⁹ was greater than predicted from the radiation dose. Also, in growth studies the inhibition observed was much greater than expected from radiation effects alone.
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ASPERGILLUS NIGER. X. POLYOL AND DISACCHARIDE PRODUCTION FROM ACETATE. S. A. Barker, A. Gomez-Sanchez, and M. Stacey. (Univ. Birmingham, Engl.). *J. Chem. Soc.* 1958, 2583-6. CA-52: 17368b.
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EFFECT OF INTERNAL IRRADIATION ON EXPERIMENTAL VIRAL AND RICKETTSIAL INFECTIONS. COMMUNICATION I. EFFECT OF RADIOACTIVE PHOSPHORUS ON THE SUSCEPTIBILITY OF WHITE MICE TO VACCINIA VIRUSES. T. A. Bektemirov and Iu. N. Mastiukova. *Vop. Virusol* 5, 221-5(1960) Mar.-Apr.
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ASSIMILATION OF CARBON DIOXIDE BY HYDROGEN BACTERIA. Fred H. Bergmann, Jack C. Towne, and R. H. Burris. (Univ. of Wisconsin, Madison). *J. Biol. Chem.* 230, 13-24(1958). CA-52: 9312a.
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DEGRADATION STUDIES ON CELLULAR CONSTITUENTS ISOLATED FROM STREPTOMYCES GRISEUS BY UTILIZING C¹⁴-LABELED CARBOHYDRATES. Jerzy J. Bialy. (Oregon State Coll., Corvallis). Univ. Microfilms. (Ann Arbor, Mich.), Publ. No. 24626, 102p.; *Dissertation Abstr.* 18, 392(1958). CA-52: 7433d.
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EFFECT OF PYRIDOXAL ON UPTAKE OF CARBON-14 ACTIVITY FROM LABELED ISONIAZID BY MYCOBACTERIUM TUBERCULOSIS. Irene U. Boone, Verda G. Strang, and Betty S. Rogers. *Am. Rev. Tuberc. Pulmonary Diseases* 76, 568-78(1957). CA-53:3361c.
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UTILIZATION OF THE IMIDAZOLE CARBON-2 OF HISTIDINE FOR THE BIOSYNTHESIS OF PURINES IN BACTERIA. Helen R. Bowser, Revel and Boris Magasanik. (Harvard Med. School, Boston, Mass.). *J. Biol. Chem.* 233, 439-43 (1958). CA-53: 1466h.
- 361** STUDIES ON THE INFLUENCE OF TRITIUM RADIATION ON ANAEROBIC BACTERIA FROM THE BOVINE RUMEN. J. Brueggemann and D. Giesecke (Universität, Munich). p.179-87 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)
The bacterial flora in the bovine rumen is mainly composed of strictly anaerobic species supplying the host with large amounts of volatile fatty acids (VFA's) as the main energy source. Long time *in-vitro* irradiations of the flora with T₂O in a so-called "artificial rumen" under anaerobic conditions have shown that doses up to 75 krad had no inhibitory effect on bacterial growth and VFA-production. Stimulatory effects resulting in acceleration of cell division and increased amounts of VFA's were observed after irradiating the resting flora at 0°C with a total dose of about 300 krad within 20 days, but reproducibility was unsatisfactory because of the heterogeneity of the material. Further experiments were carried out on pure cultures of selected strains of rumen bacteria. Doses up to 150 krad (5 days) did not markedly influence anaerobic growth and carbohydrate metabolism. However, if oxygen was present during the irradiation of resting cells a strong reduction in viable numbers was noted. Oxygen *per se* was found to exert a lethal effect on these species following a logarithmic order of decline. It is assumed that secondary radiation products, especially H₂O₂, are mainly responsible for the action of T₂O on these microorganisms which are devoid of catalase. Some confirmatory results are still to be obtained.
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SOME GROWTH REQUIREMENTS OF HEMOPHILUS INFLUENZAE AND HEMOPHILUS PERTUSSIS. W. Brumfit (St. Mary's Hosp. Med. School, London). *J. Pathol. Bacteriol.* 77, 95-100(1959). CA 53-8290i
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FORMATION OF POLYPHOSPHATES IN YEAST CELLS. E. Bukhovich and A. N. Belozerskii. (M. V. Lomonosov State Univ. Moscow). *Biokhimiya* 23, 254-60(1958). CA-52: 12995c.
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AUTORADIOGRAPHIC STUDY OF PENETRATION OF SENDAI VIRUS INTO TISSUE CULTURE CELLS. II. USE OF VIRUS PREPARATIONS LABELLED WITH P-32. A. G. Bukrinskaya, V. M. Zhdanov, and G. P. Ramenskaya. *Vop. Virusol.* 6, 593-9(1961)
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SITE OF PROTEIN SYNTHESIS IN BACILLUS MEGATERIUM. J. A. V. Butler, A. R. Crat-horn, and G. D. Hunter. (Royal Cancer Hosp., London). *Biochem. J.* 69, 544-53(1958). CA-52: 18631d.
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EVOLUTION OF SEVERAL EXPERIMENTAL VIRUS DISEASES (INFLUENZA, POLIOMYELITIS, COXSACKIE VIRUS DISEASE, RABIES, HERPES) UNDER THE INFLUENCE OF RADIOPHOSPHORUS (P-32) AND RADIOIODINE (I-131). N. Cajal, O. Burducea, S. Mateescu, G. Marinescu, M. Cepleanu, and Y. Copelovici. *Stud. Cercet Inframicrobiol.* 12, 29-37(1961)

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LOCALIZATION OF DEOXYRIBONUCLEIC ACID IN *ESCHERICHIA COLI*. Lucien G. Caro, Robert P. Van Tubergen, and Frederick Forro, Jr. (Yale Univ.). J. Biophys. Biochem. Cytol. **4**, 491-4(1958). CA-52: 20384b.

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EFFECTS OF DEUTERIUM OXIDE UPON PLAQUE FORMATION AND REPLICATION OF SIMIAN VIRUS 40. R. I. Carp, I. Chudnow, H. Koprowski, and D. Kritchevsky. Proc. Soc. Exp. Biol. Med. **113**, 569-71(1963) July

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EFFECTS OF DEUTERIUM OXIDE UPON POLIOVIRUS MULTIPLICATION. Richard I. Carp, David Kritchevsky, and Hilary Koprowski (Wistar Inst. of Anatomy and Biology, Philadelphia). Virology, **12**: 125-7(Sept. 1960).

The effects of deuterium oxide on the multiplication of CHAT, an attenuated type of poliomyelitis virus, was studied in cells of HeLa and of monkey kidney cells in primary cultures. Yields of virus obtained from deuterated cells were consistently higher than those obtained from controls. The incorporation of deuterium oxide in the growth media resulted in an increase in the average plaque size of polio virus.

370

A/CONF.15/P/1386
A STUDY OF PHAGE INACTIVATION BY ASSIMILATED P32. C. Castagnoli and F. Graziosi (Univ. of Rome). 18p.

Results are reported from a study of bacteriophage inactivation following assimilation of phosphorus-32. Data are included on inactivation due to external non-assimilated phosphorus-32, the inactivation of dry phage by assimilated phosphorus-32, and the effect of temperature and state of the medium on the inactivation of labeled bacteriophage.

371

MECHANISM OF ANTIBIOTIC ACTION. XI. A NITROGEN-15-TRACER STUDY OF THE EFFECT OF CHLORAMPHENICOL ON THE NITROGEN METABOLISM OF *ESCHERICHIA COLI*. Jirina Cerna, Frantisek Sorm, and Vladimir Cermak. (Czech. Acad. Sci., Prague). Chem. listy **51**, 1932-8(1957). CA-52-2171e.

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A PROTEOLYTIC SYSTEM IN GROWING AND NONGROWING CELLS OF *ESCHERICHIA COLI*. J. Chaloupka and J. Liebster (Českoslov. akad. věd., Prague). Folia microbiol. **4**, 167-75(1959)(in English). CA 53-22256d

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A/CONF.15/P/2115
ISPOL'ZOVANIE MECHENYKH SUBSTRATOV DLYA IZUCHENIYA VNUTRIKLETOCHNYKH PROTEAZ. (The Use of Labeled Substrates for the Study of Intracellular Proteases). J. Chaloupka, J. Liebster, and J. Janeček (Czechoslovakia). 10p.

For the study of the intracellular proteolytic system of the microorganism *Escherichia coli*, casein labeled with I^{131} and bacterial proteins from *E. coli* bio-synthetically labeled with S^{35} were used. Casein- I^{131} proved to be most satisfactory especially because of the simplicity of the radioactivity measurements. The

sensitivity and exactness of the determination of the proteolytic activity by means of labeled substrates proved superior to the usual methods. The enzymatic activity in the extracts from bacterial homogenates was investigated. The hydrolysate of casein- I^{131} was chromatographed. An undetermined spot not corresponding to either iodide, diiodo-, or moniodo-tyrosine was observed. This spot probably belongs to I^{131} -peptides. The proteolytic system splits casein as well as the bacterial proteins, the optimum pH being between 7.0 and 8.5. The activity of the proteolytic system is considerably decreased by p-chloromercuribenzoic acid, compounds forming metal complexes being ineffective. Hydrolysis of I^{131} -casein by freshly prepared extracts proceeds approximately linearly during the first two hours. The activity of extracts preincubated without substrate at +5°C or +25°C did not increase. This proves the absence of the zymogenic form of the corresponding enzyme in the cell. The presence of bacterial proteins in the extracts does not interfere with the determination of the proteolytic activity by means of labeled substrates.

374

EFFECTS OF 8-AZAGUANINE ON THE SYNTHESIS OF PROTEIN AND NUCLEIC ACIDS IN *BACILLUS CEREUS*. H. Chantrenne and S. Devreux. (Univ. Brussels). Nature **181**, 1737-8(1958). CA-53: 1459e.

375

CARBOHYDRATE ASSIMILATION IN ACTIVELY GROWING YEAST, *SACCHAROMYCES CEREVISIAE*. I. METABOLIC PATHWAYS FOR THE UTILIZATION OF CARBON-14-LABELED GLUCOSE BY YEAST DURING AEROBIC FERMENTATION. S. L. Chen (Red Star Yeast and Products Co., Milwaukee, Wis.). Biochim. et Biophys. Acta **32**, 470-9(1959)(in English). CA 53-15228d

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CARBOHYDRATE ASSIMILATION IN ACTIVELY GROWING YEAST, *SACCHAROMYCES CEREVISIAE*. II. SYNTHESIS OF POLYSACCHARIDES FROM CARBON-14-LABELED GLUCOSE. S. L. Chen (Red Star Yeast and Products Co., Milwaukee, Wis.). Biochim. et Biophys. Acta **32**, 480-4(1959)(in English).

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PHOSPHATE-WATER EXCHANGE REACTION CATALYZED BY INORGANIC PYROPHOSPHATASE OF YEAST. Mildred Cohn. (Washington Univ., St. Louis, Mo.). J. Biol. Chem. **230**, 369-79(1958). CA-52: 9312d.

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NUCLEIC ACID BIOSYNTHESIS AND PHAGE T2 GROWTH IN Co-60 IRRADIATED *E. B. COLI*. C. W. Wu, et al. J. Formosa Med. Ass. **62**, 218-25(1963) Mar. 28

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INCORPORATION OF AMINO ACIDS INTO PROTEIN OF AZOTOBACTER VINELANDII CELL FRACTIONS. George E. Connell, Peter Lengyel, and Robert C. Warner (New York Univ., New York, N.Y.). Biochim. et Biophys. Acta **31**, 391-7(1959)(in English). CA 53-11515c

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- 381** A/CONF.15/P/1089
USE OF K⁴² IN THE DETERMINATION OF THE AMOUNT OF K CARRIER IN THE YEAST CELL WALL. E. J. Conway and P. F. Duggan (University Coll., Dublin). 11p.
Potassium ions are actively transported into the cells when glucose in solution is fermented by yeast in the presence of potassium. A procedure is described for determining the concentration of the cation carrier in this reaction. Potassium ions labeled with potassium-32 were displaced from the carrier by means of excess rubidium, and the displaced potassium ions were measured by determining the radioactivity of the suspending fluid. The carrier system is considered to be a metal redox system, and the reaction mechanisms involved are discussed.
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EFFECT OF AN ISOTOPE (I-131) ON THE VIRULENCE OF B. C. G. AND ON THE ALLERGY PRODUCED BY THIS BACILLUS. E. Coulaud. Rev. Tuberc. (Par) **23**, 1045-6(1959) Oct.-Nov.
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NUCLEIC ACID METABOLISM AND RIBONUCLEIC ACID HETEROGENEITY IN ESCHERICHIA COLI. Joan L. Countryman and Elliot Volkin (Oak Ridge Nat'l. Lab., Oak Ridge, Tenn.). J. Bacteriol. **78**, 41-8(1959). CA 53-18168d
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SITE OF PROTEIN SYNTHESIS IN BACILLUS MEGATERIUM. A. R. Crathorn and G. D. Hunter. (Roy. Cancer Hosp., London). Biochem. J. **68**, 4P(1958). CA-53:2344f.
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DEOXYRIBONUCLEIC ACID SYNTHESIS IN BACTERIOPHAGE-INFECTED ESCHERICHIA COLI. L. V. Crawford. (Univ. Cambridge, Engl.). Biochem. J. **65**, 17P(1957). CA-53:2343h.
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CULTIVATION OF MICROORGANISMS IN HEAVY WATER. H. L. Crespi, S. M. Conrad, R. A. Uphaus and J. J. Katz. Ann. N. Y. Acad. Sci. **84**, 618-66(1960) Nov. 25
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CULTURE OF ALGAE AND OTHER MICRO-ORGANISMS IN DEUTERIUM OXIDE. H. L. Crespi, S. M. Archer, and J. J. Katz. Nature (Lond) **184**, (Suppl. 10), 729-30(1959) Aug.
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PYRIMIDINE BIOSYNTHESIS IN ESCHERICHIA COLI. G. W. Crosbie. (Univ. Glasgow, Scot.). Biochem. J. **69**, 1P(1958). CA-53: 496a.
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CARBOHYDRATE METABOLISM IN SARCINA LUTEA. EVALUATION OF THE ROUTES OF GLUCOSE UTILIZATION BY SARCINA LUTEA. E. A. Dawes and W. H. Holms. (Univ. Glasgow, Scot.). Biochem. J. **66**, 24P-25P(1957). CA-53: 5384b.
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MUTATION AND KILLING OF ESCHERICHIA COLI WP-2 BY ACCELERATED HEAVY IONS AND OTHER RADIATIONS. R. A. Deering. Radiat. Res. **19**, 169-78(1963) May
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THE EFFECTS OF DEUTERIUM OXIDE ON BACTERIA. R. De Giovanni. Z. Vererbungsl. **92**, 389-402(1961)
- 393**
STUDIES ON INCORPORATION OF DEUTERIUM INTO BACTERIA. R. De Giovanni and S. Zamenhof. Biochem. J. **87**, 79-82(1963) Apr.
- 394** THE EFFECTS OF DEUTERIUM OXIDE ON CERTAIN MICROORGANISMS Rosali de Giovanni (Columbia Univ., New York). Ann. N. Y. Acad. Sci., **84**: 644-7(Nov. 25, 1960).
The growth of several strains of *E. coli* and *B. subtilis* was inhibited by the presence of D₂O; the degree of inhibition exhibited by each strain was specific. The addition of 0.5% NaCl to the D₂O media decreased the inhibition of growth. A deuterium-resistant mutant was obtained from one strain of *E. coli*. The incorporation of deuterium induces not only phenotypic but also genotypic changes in microorganisms. The effects induced by deuterium depend, however, on the genotype of the strain. The isotope appears to be mutagenic for some strains and some loci but not for others. Various types of forward mutations were obtained in some of the bacterial strains tested and the frequency of backward mutation was increased in two strains exposed to deuterium. Thymine containing deuterium, possibly in its methyl group, is not capable of inducing any detectable changes in a thymine requiring mutant. Cells, grown in D₂O media and subsequently washed and irradiated in H₂O-saline, are more sensitive to ultraviolet irradiation than control cells.
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METABOLISM OF VALINE, PROLINE, LEUCINE, AND ISOLEUCINE BY RUMEN MICROORGANISMS IN VITRO. Burk A. Dehority, Ronald R. Johnson, Orville G. Bentley, and A. L. Moxon. (Ohio Agr. Expt. Sta., Wooster). Arch. Biochem. Biophys. **78**, 15-27(1958). CA-53:5406i.
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THE UTILIZATION OF ETHANOL FOR BIOSYNTHESIS IN ESCHERICHIA COLI. R. F. DeLeon and E. H. Creaser. (McGill-Montreal Gen. Hosp.). Can. J. Biochem. and Physiol. **36**, 839-45(1958). CA-52: 18661h.
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QUANTITATIVE ASPECTS OF THE TRICARBOXYLIC ACID CYCLE IN BAKERS' YEAST. J. A. DeMoss and H. E. Swim. (Western Reserve Univ., Cleveland, O.). J. Bacteriol. **74**, 445-51(1957). CA-52-3018e.

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- 411** EFFECT OF STREPTOMYCIN ON THE INCORPORATION OF AMINO ACIDS LABELED WITH CARBON-14 INTO RIBONUCLEIC ACID AND PROTEIN IN A CELL-FREE SYSTEM OF A *MYCOBACTERIUM*. T. Erdos and Agnes Ullmann (Univ. Budapest, Hung.). *Nature* 182, 618-19(1959). CA 53-15204g
- 412** IRON AS A GROWTH REQUIREMENT FOR PATHOGENIC *LEPTOSPIRA*. S. Faine (Otago Univ. Med. School, Dunedin, N.Z.). *J. Gen. Microbiol.* 20, 246-51(1959). CA 53-15204e
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- 414** DEOXYRIBONUCLEIC ACID (DNA) INCORPORATION BY TRANSFORMED BACTERIA. Maurice S. Fox. (Rockefeller Inst. for Med. Research, New York, N. Y.). *Biochim. et Biophys. Acta* 26, 83-5(1957)(In English). CA-52-1359f.
- 415** THE EFFECT OF DEUTERIUM OXIDE ON *ECTROMELIA VIRAL* INFECTION. S. W. French, A. M. Hughes, and B. V. Siegel. *Lab. Invest.* 10, 865-71(1961) Sept.-Oct.
- 416** INACTIVATION OF BACTERIAL VIRUSES BY PHYSICAL METHODS. C. R. Fuerst. *Ann. N. Y. Acad. Sci.* 83, 684-91(1960) Jan. 13
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APPLICATION OF THE KINETIC ISOTOPIC METHOD TO THE STUDY OF BACTERIAL NUTRIENT TRANSPORT. D. Gal and T. E. Vago. (Agrochem. Research Inst., Budapest, Hung.). *Zentr. Bakteriöl., Parasitenk. Abt. II*, **111**, 546-52(1958). *CA-53:2361g*.

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SYNTHESIS OF CHITIN IN CELL-FREE EXTRACTS OF NEUROSPORA CRASSA. Luis Glaser and David H. Brown. (Washington Univ., St. Louis, Mo.). *J. Biol. Chem.* **228**, 729-42(1957). *CA-52:3027i*.

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UTILIZATION OF ACETATE-C¹⁴ BY ESCHERICHIA COLI GROWN ON ACETATE AS THE SOLE CARBON SOURCE. Alvin J. Glasky and Max E. Rafelson, Jr. (Univ. of Illinois, Chicago). *J. Biol. Chem.* **234**, 2118-22(1959). *CA 53-2028oi*

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MICROBIOLOGICAL FRACTIONATION OF THE HYDROGEN ISOTOPES. P. E. Gloud, Jr., Irving Friedman, and F. D. Sisler (U. S. Geological Survey, Washington) and V. H. Dibeler (National Bureau of Standards, Washington). *Science* **127**, 1394-5(1958) June 13.

As a part of a comprehensive plan of study of Bahamas sediments collected in May 1955, bacteriological analyses of the refrigerated samples were undertaken, beginning early in 1956. It was soon observed that a yet unidentified facultative aerobe found in teeming abundance in aragonite muds from a mid-bank locality west of Andros Island produced gas vigorously when it was cultured in a dextrose medium. It seemed likely that this gas was largely CO₂, but a check-analysis was sought from the Mass Spectrometry Section of the National Bureau of Standards. That analysis showed 26.3% carbon dioxide and 63.4% hydrogen; the latter, within the resolving power of the apparatus, appeared to consist exclusively of common light hydrogen. The balance was 5.3% water vapor, 4.6% nitrogen, and 0.4% oxygen.

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FATE OF IODINE-131 LABELED ANTIGENS OF DYSENTERIAL BACILLI AFTER ORAL ADMINISTRATION IN ANIMALS. V. V. Grechko and T. S. Sedova. *Zh. Mikrobiol.* **31**, 117-22(1960) Nov.

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ON THE PREPARATION AND PROPERTIES OF I-131-LABELED ANTIGENS OF DYSENTERIAL BACTERIA. V. V. Grechko, T. S. Sedova. *Biokhimiia* **24**, 858-65(1959) Sept.-Oct.

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TRACER STUDIES OF FUNGICIDAL ACTION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 71,

Session 1. R. W. Greenlee, H. T. Kemp, R. S. Davidson, and M. M. Baldwin (Battelle Memorial Inst., Columbus, Ohio). New York, American Institute of Chemical Engineers, 1958. 29p.

An attempt was made to correlate the sorption uptake of compounds of equal inherent toxicity with differential fungicidal effects. Two homologous series of compounds containing toxic moieties provided pairs which seemed suitable for a radiotracer sorption study of this relationship. The pairs chosen were potassium dimethyldithiocarbamate and potassium di-n-propyldithiocarbamate and N-n-butyl-ethylenethiourea and N-n-propyl-ethylenethiourea. The former member of each pair was decidedly more fungicidal than the latter. Chemical studies were made to demonstrate the chemical similarity and to find convenient preparative methods for these compounds. Radiosyntheses involved the incorporation of sulfur-35 in each case. In the case of the dithiocarbamate salts, the innocuous di-n-propyl derivative was more strongly sorbed than the toxic dimethyl compound. Similarly, with the N-alkylethylenethioureas, the less fungicidal n-propyl derivative was more strongly sorbed than the n-butyl compound. A possible explanation of the lack of toxic effect by the apparently inactive compounds is that, in these cases, the exercise of inherent toxicity is prevented by preferential sorption on the fungus spore wall.

426

STUDIES IN THE BIOGENESIS OF MACROLIDES BY MEANS OF PROPIONIC ACID (1-C¹⁴-3-T). H. Grisebach, H. Achenbach, and W. Hofheinz (Universität, Freiburg i. B.). p.139-45 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The fundamental structure of the antibiotic erythromycin consists of a lactone ring in glucosidic connection to two sugars. The regular arrangement of C-methyl groups in erythromycin led Gerzon to believe that the biogenesis of the lactone ring is possibly brought about by seven units of propionate. For investigating this hypothesis, propionic acid, the methyl group of which was labeled with tritium whereas the carboxyl group was labeled with carbon-14 was synthesized. It is shown that, when this acid was added to *Streptomyces erythreus*, the C¹⁴/T ratio in erythromycin (measured with a gas counting tube) was reduced only by 14 to 25% as against the ratio of the propionic acid. When the sugars were split off the C¹⁴/T ratio remained constant. Decomposition of the lactone ring by Kuhn-Roth oxidation showed that more than 90% of the tritium was in the methyl groups and more than 90% of C¹⁴ in those places, which had to be labeled if the propionic acid had been fitted in properly. The advantages of labeling the acid with tritium as well as with C¹⁴ are also reflected by another concurrent experiment with propionic acid (3-T) and acetic acid, 1-C¹⁴. It could be concluded from the changes in the C¹⁴/T value that propionic acid is by far more readily taken up by erythromycin than acetic acid. These results and further experiments prove that the lactone ring of erythromycin is, indeed, made up of seven units of propionate. Similar experiments were carried out on the biogenesis of magnamycin.

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ROLE OF AMINO ACIDS IN NUCLEIC ACID SYNTHESIS IN ESCHERICHIA COLI. F. Gros and Françoise Gros-Doulcet (Inst. Pasteur, Paris). *Exptl. Cell Research* **14**, 104-31(1958) (in French). *CA 53-10367h*

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TRANSLOCATION OF COBALT-60 AND CESIUM-137 BY FUNGI IN AGAR AND SOIL CULTURES. E. Grossbard and D. R. Stranks. Nature (London) **184**, 310-4 (1959) Aug.
- 429** COMPARATIVE FIXATION OF VARIOUS RADIOACTIVE PHOSPHOROUS SAMPLES BY BACTERIA. Antonina Guelin and Pierre Lepine (Institut Pasteur, Paris, France). Ann. inst. Pasteur, 101: 281-4 (Aug. 1961). (In French)
The fixation of P^{32} on killed bacteria varied greatly according to the sample used. The differences in the fixation seem to be independent of the specific radioactivity of the samples used and of their disintegration stage.
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DISTRIBUTION OF RADIOACTIVE PHOSPHORUS IN HEAT-KILLED BACTERIA. A. Guelin and P. Lepine. Ann. Inst. Pasteur (Par) **101**, 677-86 (1961) Nov.
- 431** A/CONF.15/P/332
SUR LA FIXATION DU RADIOPHOSPHORE MINERAL (P^{32}) PAR DES CELLULES BACTERIENNES EN CROISSANCE. (Fixation of Mineral Radiophosphorus (P^{32}) by Bacterial Cells in Growth.) A. Guelin and P. Lepine (Institut Pasteur, Paris). 8p.
Radiophosphorus is used in the study of the metabolic processes in bacteria and bacteriophagocytes. However, the phosphorus distribution and the conditions under which assimilation occurs are not well defined. An investigation was made with *Shigella paradysenteriae* Y6R on this problem. The results showed that P^{32} does not augment the multiplication of either the bacteria or the bacteriophage C16 associated with it. The phosphorus is retained in larger quantities by bacteria which are multiplying. The larger part of P^{32} retained appears to be attributable to adsorption on the bacterial surface rather than to assimilation.
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RADIOSENSITIVITY OF BACTERIA TO PHOSPHORUS P^{32} IN THE ABSENCE OF P^{31} IN THE MEDIUM. A. Guelin and P. Lepine. Ann. Inst. Pasteur (Paris) **104**, 450-9 (1963) Apr. (Fr)
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NITROGEN ASSIMILATION OF BREWERS' YEAST. Hans Guthenberg, Lennart Enebo, and Evald Sandegren. Svensk Bryggeritidskr. **69**, 81-8 (1954). CA-52: 10277g.
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DORMANCY OF BACTERIAL ENDOSPORES: REGULATION OF ELECTRON TRANSPORT BY DIPICOLONIC ACID. Harlyn O. Halvorson, Roy Doi, and Brooks D. Church (Univ. of Wisconsin, Madison). Proc. Natl. Acad. Sci. U.S. **44**, 1171-80 (1958). CA 53-12404a
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ON THE SYNTHESIS OF PROTEIN AND POLYNUCLEO-
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PROTECTION OF *STAPHYLOCOCCUS AUREUS* FROM SOME EFFECTS OF PENICILLIN BY MEDIA OF HIGH OSMOTIC PRESSURE. R. Hancock. (Univ. Cambridge, Engl.). Biochem. J. **70**, 15P (1958). CA-53:3359e.
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EFFECTS OF P^{32} DECAY ON TRANSDUCTION BY *SALMONELLA* PHAGE P-22. P. E. Hartman and A. W. Kozinski. Virology **17**, 233-44 (1962) June
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NEW PEPTIDE-NUCLEOTIDE COMPOUNDS OBTAINED FROM *CHLORELLA* AND YEASTS. Eiji Hase, Sayoko Mihara, Hama Otsuka, and Hiroshi Tamiya (Univ. Tokyo). Biochim. et Biophys. Acta **32**, 298-300 (1959) (in English). CA 53-22242d
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CONVERSION OF D-GLUCOSE TO L-FUCOSE BY *AEROBACTER CLOACAE*. Edward C. Heath and Saul Roseman. (Univ. of Michigan, Ann Arbor). J. Biol. Chem. **230**, 511-19 (1958). CA-52: 9312h.
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(Mutagenes Wirking des Zerfalles von Radioaktivem Phosphor Nach Einbau in Zellen von *Escherichia Coli*). F. Kaudewitz, W. Vielmetter, and H. Friedrich-Freska. Translated from *Z. Naturforsch.* 13b, 793-802(1958). 14p. JCL.

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MUTATING EFFECTS OF THE DECAY OF RADIOACTIVE PHOSPHORUS AFTER INCORPORATION IN CELLS OF *ESCHERICHIA COLI*. F. Kaudewitz, W. Vielmetter, and H. Friedrich-Freska (Max-Planck-Institut für Virusforschung, Tübingen, Ger.). *Z. Naturforsch.* 13b, 793-802(1958) Dec. (In German)

Cells of *E. coli* labeled with P^{32} undergo inactivation during storage in liquid nitrogen (-196°C). Thawing the samples after storage and plating them immediately on complete medium yield colonies of uniform appearance. However, replica plating on minimal medium demonstrates that during P^{32} decay there occurred a significant increase in nutritionally deficient (auxotrophic) mutants. When 10^{-4} is the survival rate, 0.67% of surviving cells give rise to auxotrophic colonies, 40 to 50% of which have prototrophic sectors. During storage the increase of mutants is linear with respect to inactivation of bacteria and to the fraction of P^{32} decayed. The experiments carried out show that inactivation and mutation are due to the decay of P^{32} atoms incorporated in cellular structures and not to effects of freezing, toxicity of contaminants present in the P^{32} solution, or ionization of β electrons. An increase of mutants by positive selection in the course of inactivation was excluded experimentally.

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D₂O increases the viral yield at supra-optimal temperatures and decreases it at infra-optimal ones. The effect in one or the other direction is all the more marked that the concentration of D₂O is higher. D₂O increases the duration of the primary phase. This increase is all the more important that the temperature is lower and that the rt of the strain is higher. For a given supra-optimal temperature, the effect of D₂O is all the more higher that the rt of the strain is lower. For a given infra-optimal temperature, the effect of D₂O is all the more marked that the rt of the strain is higher. D₂O as an agent increasing the effects of infra-optimal temperatures acts on a primary phase of the viral cycle. Once the primary phase is completed, D₂O does not affect the rate of viral development. D₂O as an agent decreasing the effect of supra-optimal temperatures acts on the secondary phase of the viral cycle. The pre-incubation of cells in the presence of D₂O does not modify the viral development as a function of the temperature. A development of three hours in the presence of D₂O is without effect on the subsequent viral development in the absence of D₂O. Virions developed at supra-optimal temperature in the presence of D₂O do not show a modified genotype.

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- In previous investigations it was demonstrated that
the autotrophic sulfur bacteria *Th. thioparus* utilize
only the sulfhydryl group of the thiosulfate molecule.
When the -SH group of thiosulfate was labelled with
 S^{35} , the elementary sulfur and sulfate were radioactive.
When the central sulfur atom of thiosulfate was
labelled, no radioactivity was detectable in the free
sulfur. In the present investigation it was found that
hydrogen sulfide is oxidized to free sulfur and sulfate
ion. The labelled cysteine and alanylthiosulfate also
undergo oxidation; the cysteine is metabolized only in
the presence of thiosulfate in the medium. Further
studies were undertaken on the primary organic inter-
mediate products containing radioactive sulfur from
thiosulfate labelled in both positions. By means of
various methods, especially paper chromatography,
paper electrophoresis, and autoradiography it was
possible to identify several organic sulfur-containing
substances. From the appearance of these labelled
intermediates the possible pathway of thiosulfate
oxidation was inferred. The mode of utilization of
energy from inorganic substances and its transforma-
tion for the processes of life are suggested. The free
amino-acid pool and the sequence of its synthesis with
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of energy. Vitamin B_{12} was synthesized labeled with
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labeled simultaneously with carbon-14, cobalt-60, and
phosphorus-32. Quantitative estimation of vitamin B_{12}
activity was made by microbiological tests with *Euglena*
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A/CONF.15/P/2003

Rochester, N. Y. Univ. School of Medicine and Dentistry.

THE MECHANISM OF TRANSPORT OF BIVALENT CATIONS INTO THE YEAST CELL. Aser Rothstein. 15p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Isotope techniques are particularly useful in the study of exchanges of cations across cell membranes. In the case of bivalent cations, useful isotopes are available for a number of physiologically important elements such as Ca, Sr, Mn, Zn, and Co, but not for Mg. Fortunately Mn and Mg behave similarly. Previous studies with bivalent cations indicate that two basic phenomena are involved; a reversible binding of the cations by anionic groups of the cell surface, and an essentially irreversible active-transport of the cations into the interior of the cell. The latter process requires energy derived from glycolysis, is related to the absorption of phosphate and potassium, and is relatively specific for Mg and Mn as compared with Ca and Sr. If the term "carrier" is applied to the membrane substances involved in the active transport process, then the evidence suggests that the "carrier" for Mg and Mn is a phosphorylated product formed from extracellular

phosphate. Thus, starved cells possess no capacity to transport the bivalent cations, nor does such a capacity appear during the active turnover of intracellular phosphate associated with metabolism. However, during the active transport of extracellular inorganic phosphate into the cell, the capacity to absorb Mg and Mn is acquired; a capacity which is retained for many hours in quiescent cells, but which disappears rather rapidly in glycolysing cells. The chemical nature of the cation-carrier is not specifically known. The conclusion that a phosphate compound is involved is based on the following facts: synthesis occurs only during phosphate absorption; breakdown is rapid during glycolysis; inhibition is observed with arsenate, a substance closely related to phosphate. The carrier is not identifiable with any of the known phosphate compounds of the cell. It is formed in small amounts from only a fraction of the absorbed phosphate, and therefore must function in a cyclic manner with a rapid turnover. The specificity pattern of the absorption process suggests that a protein is also involved. Both transport processes, that of phosphate and that of the bivalent cations, are membrane phenomena that are essentially irreversible, that is, no exchanges occur across the membrane. Both processes are coupled to a specific mode of metabolism, glycolysis, presumably at the glyceraldehyde-3-phosphate dehydrogenase reaction. The coupling is neither stoichiometric nor obligatory. The molecular mechanism is not known in either case, and further analysis of the situation is limited by lack of information concerning the intimate structure of the cell membrane

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 THE FUNCTION OF THE CITRIC ACID CYCLE IN SACCHAROMYCES CEREVISIAE. A. O. M. Stoppani, Susana L. S. de Favelukes, Lucia Conches, Eugenia Ramos, and M. Martha Pigretti (Comisión Nacional de Energía Atómica, Buenos Aires and Univ. of Buenos Aires). 30p.
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 ASSIMILATION OF CARBON DIOXIDE BY YEAST.

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Results are reported from an investigation of the biosynthesis of the antibiotic substance, erythromycin, by Streptomyces erythreus grown on synthetic culture media containing substrates labeled with carbon-14.
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ACCUMULATION OF RADIOSTRONTIUM BY BACTERIAL CELLS. V. M. Zhogova. Gigiena i Sanit., No. 4: 5-9(1961).

Similar to other aquatic organisms, bacteria are capable of accumulating considerable amounts of strontium-90 from the water polluted with the isotope. In an hour the microbic cells become 10 to 100 times more radioactive than the surrounding medium, and, consequently, they are an important link in the food chains by means of which radioactive strontium may reach the body of men and animals from the polluted water basins. It was noted that the smaller concentration of bacterial suspension and the lower the specific activity of medium, the higher the coefficient of radio-strontium accumulation in bacterial cells. However, irrespective of the concentration of microbes, the bacterial suspension extracts from the liquid medium an average of 10% of strontium-90. Therefore bacterial and activated sludge may not be successfully used for the removal of this isotope from the radioactive wastes and effluents. The process of physico-chemical adsorption is most probably the basis of the strontium accumulation in bacterial cells. (Public Health Eng. Abstr., 41: No. 8, 1961)

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STUDY OF THE RESTORATION OF WATER IN SEVERELY UNDERNOURISHED CHILD (KWASHIORKOR) WITH TRITIATED WATER. C. Paque. Med. Monde 37, 15-9(1961)

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CAESIUM-137 IN DRIED MILK PRODUCTS IN RELATION TO PHYTOCLIMATIC ZONES. W. H. Rickard, A. D. Wiggins, and J. K. Fremstad. Nature (London) 197, 197-8(1963) Jan. 12

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TOTAL BODY FAT DETERMINED BY POTASSIUM-40 CONTENT. *Nutr. Rev.* 19, 134-5 (1961) May

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ZINC-65 AND ZIRCONIUM-95 IN FOOD. Marvin A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). *Science* 131, 659-60 (1960) Mar. 4.

Zinc-65 has been found in small amounts in muscle and liver samples obtained from cattle raised in Nevada, and also in commercial hamburger and beef liver from the southwestern area. Zirconium-95 and niobium-95 were found in the liver samples but not in the muscle or hamburger. A trace of zinc-65 was detected in milk but none in people.

642

WOULD CALCIUM FROM BONE MEAL BE BETTER UTILIZED THAN FROM APATITE? STUDIES ON THE RESORPTION OF CALCIUM-45 FROM APATITE OR BONE-MEAL IN MAN. E. M. Warkalla and K. Schreier. *Muenchen Med. Wschr.* 102, 2150-2 (1960) Oct. 28

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EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON BODY BURDENS OF INGESTED RADIO-STRONTIUM. R. H. Wasserman and C. L. Comar. *Proc. Soc. Exp. Biol. Med.* 103, 124-9 (1960) Jan.

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EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON BODY BURDENS OF INGESTED RADIO-STRONTIUM. R. H. Wasserman and C. L. Comar (State Univ. Veterinary Coll., Ithaca, N. Y.). *Proc. Soc. Exptl. Biol. Med.* 103, 124-9 (1960) Jan.

It is emphasized that long term effects of dietary constituents on radiostrontium must be determined either by long term experiments or predicted from double tracer technics. Previous reports in disagreement as to the effect of increased dietary calcium on radiostrontium were reconciled by the following predictions: in immature rats, elevated dietary calcium levels (within physiological ranges) with or without increased phosphorus levels would almost proportionately reduce the body burden of dietary radiostrontium; in mature rats; elevated dietary calcium levels alone would not proportionately reduce the radiostrontium; and in mature rats, simultaneous increases in dietary calcium and phosphorus levels would to some degree reduce the ultimate body burden of radiostrontium.

645

EFFECTIVENESS OF DIETARY SUBSTANCES IN REDUCING THE RETENTION OF CHRONICALLY INGESTED RADIOSTRONTIUM: STUDIES WITH TANNIN. R. H. Wasserman and C. L. Comar (New York State Univ.,

Veterinary Coll., Ithaca). *Nature* 185, 629-30 (1960) Feb. 27.

Data are presented from a study on the influence of dietary tannin on the bone retention of continuously ingested calcium-45 and strontium-85.

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METABOLIC PATTERNS IN PREADOLESCENT CHILDREN. III. SULFUR BALANCE ON THREE LEVELS OF NITROGEN INTAKE. J. B. Wright, P. G. Martin, M. L. Skellenger, and D. S. Moschette. *J. Nutr.* 72, 314-6 (1960) Nov.

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BALANCE OF POTASSIUM, RUBIDIUM AND CAESIUM BETWEEN JAPANESE PEOPLE AND DIET AND ASSESSMENTS OF THEIR BIOLOGICAL HALF-TIMES. N. Yamagata. *Nature (London)* 196, 83-4 (1962) Oct. 6.

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IN VIVO MEASUREMENT OF IODINE-131 IN THE THYROID OF THE DAIRY COW AS AN AID FOR MONITORING MILK. N. Yamagata and K. Iwashima. *Nature (London)* 198, 169-70 (1963) Apr.

PLANT PHYSIOLOGY

649 (CEA-1860) ABSORPTION DE RADIOELEMENTS DU SOL PAR DIVERS LEGUMES CULTIVES DANS LES CONDITIONS DE LA PRATIQUE. (Absorption of Radioelements from the Soil by Various Vegetables Grown Under Normal Condition of Cultivation). (France. Institut National de la Recherche Argonomique, Paris and France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucleaires, Saclay). 1961. 31p.

Various vegetables were cultivated in 4 different types of soil, having received, or receiving periodically, Sr^{90} or Cs^{137} in fairly strong doses to facilitate the measurement of the fraction of these radioelements taken up by the vegetables. In sandy soil, whole plants absorbed 2 to 3% of Sr and 3 to 9 ppt of Cs approximately; in clay soils, 1 to 6 ppt of Sr and 0.2 to 2 ppt of Cs; Cs, however, migrated relatively more than Sr in fruits or storage organs. The experiments confirmed that the quotient of the ratios Sr^{90}/Ca in the vegetables and in the plowed layer varies comparatively slightly; there would be a certain safety margin in assuming this ratio to be slightly above unity (to be confirmed after homogenizing the plowed layer). In view of the fact that in an arid climate it is necessary to apply several tens of liters of irrigation water (up to 50) in order to produce 1 kg of vegetables (fresh whole plants) and that furthermore, the radioelements of the residue from the crop harvest return to the soil, it can be expected that the limit of accumulation 1 kg of certain vegetables will contain as much of each radioelement as several tens of liters of irrigation water.

650

M-7107

Department of Agriculture. Soil and Water Conservation Research Div., Beltsville, Md.

ACCUMULATION AND MOVEMENT OF FISSION PRODUCTS IN SOILS AND PLANTS. Quarterly Report for Period July-September 1957. Oct. 1957. 8p. \$1.80(ph), \$1.80(mf) OTS.

REFERENCES

Progress is reported in a laboratory investigation of the fixation of strontium-90 by various soil types, a study of the movement of cesium-134 in different soil types, and an experiment to determine the distribution factors for strontium and calcium in alfalfa and wheat plants.

651 ORO-169

Tennessee. Univ., Knoxville.
AGRICULTURAL RESEARCH PROGRAM. Semi-Annual Progress Report for January 1, 1957 to June 30, 1957. 54p. Contract AT-40-1-GEN-242. \$1.50(OTS).

Seventy-eight samples were irradiated at the plant and seed irradiation facility, including 67 seed samples; budwood of peach, chestnut, and grape; johnsongrass rhizomes; and sweetpotato roots. Pre-packaged irradiated barley seed and a mimeographed information letter, were prepared for distribution to high school science classes. The program is included for a symposium on Radiation in Plant Breeding held at Oak Ridge in January, 1958. Data are included from the following studies: factors controlling the metabolism of cesium and strontium in both plants and animals; the metabolism of calcium and strontium in rats; factors affecting the metabolism of calcium and phosphorus in lambs; radiation effects on reproductive physiology in cattle and rats; the relationship of survival time and whole-body gamma radiation dosage in swine, burros, and cattle; and a comparison of radium and strontium-90 toxicity in sheep. A list of publications during the period is included. (For preceding period see ORO-163.)

652 A/CONF.15/P/2312

THE EFFECT OF RHIZOSPHERE MICROORGANISMS UPON THE UPTAKE AND RELEASE OF PHOSPHORUS AND SULPHUR BY THE ROOTS OF ARBOREAL SEEDLINGS. A. I. Akhromeiko and V. A. Shestakova (U.S.S.R.). 20p.

Phosphorus-32 was used in tracer studies of the relationship between rhizosphere microorganisms and higher plants. Vigorous development of microorganisms within the rhizosphere was found to inhibit temporarily phosphorus entry into oak and ash tree seedlings, but an appreciable portion of the phosphorus taken up by the microorganisms became available for the plants after 10 days. Rhizosphere microorganisms were found to take up phosphorus compounds secreted by the seedling roots, thereby stimulating secretion of new portions of these compounds into the sand and water medium. A diurnal rhythm was noted both in the rate of root secretion of phosphorus and sulfur and in bacterial growth. Phosphorus containing root secretions also stimulated the growth of *Azotobacter* cells in the root system.

653

THE USE OF NITROGEN N^{15} IN STUDY OF THE PRODUCTS OF PHOTOSYNTHESIS. T. F. Andreeva (Inst. for Plant Physiology, Academy of Sciences, USSR). Kernenergie 3, 859-62(1960) Sept. (In German)

The synthesis of amino acids and proteins from inorganic nitrogen during photosynthesis is studied using nitrogen labeled with N^{15} . It is shown that the acceleration of forming amino acids and proteins by irradiation is caused by the fact that these compounds are directly formed during photosynthesis. In leaves free from chlorophyll, however, irradiation only accelerates the entrance of inorganic nitrogen into the plant. The influence of irradiation on the

velocity of forming proteins depends on the physiological state of the plant.

654 TID-6594

Inter-American Inst. of Agricultural Sciences. Turrialba, Costa Rica.

THE APPLICATION OF NUCLEAR ENERGY TO AGRICULTURE. Quarterly Report. July 1, 1960. 47p. Contract AT(30-1)-2043. OTS.

Preliminary results are reported from studies on the effect of pH on the foliar absorption and translocation of P^{32} applied to the leaves of coffee plants; tracer studies on the extractable phosphates from fertilizers in tropical soils; the effects of radiation exposure on flushing of rubber trees and CACAO plants and the growth of palm trees; the radiosensitivity of grasses and cotton plants; the induction of mutants following the x-ray and neutron bombardment of coffee seeds; and the induction of rice mutants following γ irradiation of seeds.

655

NON-EXCHANGEABILITY OF ^{28}Mg WITH CHLOROPHYLL a. S. Aronoff (Univ. of California, Berkeley). Biochim. et Biophys. Acta, 60: 193-5(June 18, 1962). (In English)

Results of studies on *Chlorella*, grown in a mg-reduced medium supplemented with carrier-free Mg^{28} , showed that Mg^{28} does not exchange in aqueous acetone with the Mg of chlorophyll a. A practical consequence of this absence of exchange is that the absolute kinetics of chlorophyll biogenesis or turnover may be studied without the concern of exchange with preformed chlorophyll.

656

A/CONF.15/P/401

Oak Ridge National Lab., Tenn.
STRONTIUM-90 AND CESIUM-137 UPTAKE BY VEGETATION UNDER NATURAL CONDITIONS. S. I. Auerbach and D. A. Crossley, Jr. 14p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy. 1958.

The strontium-90 and cesium-137 movement from soil to man is one of the complex problems arising from reactor operations. Most of the information on the plant to soil relationships of these two fission products has been obtained from laboratory experiments utilizing nutrient solutions, prepared soils, and soils contaminated by weapons fallout. Little work has been done on these relationships with plants grown under field conditions. Long-term studies on permanent areas contaminated with these radionuclides have not been reported.

Oak Ridge National Laboratory has an area which is uniquely suited for long-term studies under field conditions. This area was formerly a 40-acre radioactive waste impoundment (White Oak Lake) which for 12 years received a continuous input of low-level radioactive wastes. Two years ago the basin was drained, leaving about 35 acres of contaminated terrain. The resulting soil in this area can be characterized as a relatively unconsolidated alluvial sediment, heterogeneous in composition, calcareous, somewhat saline, and alkaline in reaction. Concentrations of strontium-90 and cesium-137 in the first six inches range from 0.02 to 0.29 and from 0.5 to 2.0 microcuries per 100 grams of soil, respectively. Significant concentrations of cobalt-60, ruthenium-106, cerium-144, and the trivalent rare earths are present also. The $\mu\text{C}\text{Sr}-90$ to 1 gram Ca^+ and the $\mu\text{C}\text{Cs}-137$ to 1 gram K ratios in the leaves of one of the native plants (*Polygonum lapathifolium* L.) on

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the lake bed ranged from 5.64×10^4 to 1.91×10^5 and from 7.73×10^4 to 1.67×10^5 , respectively. As a part of the investigations of uptake by vegetation, four common varieties of corn (*Zea mays*), namely, Hickory Cane, Aristogold Hybrid, Golden Bantam, and Country Gentleman, were planted in a part of the lake bed laid out in a latin square. Chemical and radiochemical (particularly strontium-90) analyses for the corn plants and native vegetation have not yet been completed nor have the data as yet been given a thorough statistical analysis. However, the first results indicate that the concentrations of cesium-137 may differ between plant organs. The cesium-137 to potassium ratios in the leaves, husks, cobs, and grain have the following ranges: Leaves, 2.93×10^4 to 5.87×10^4 ; husks, 2.18×10^4 to 4.18×10^4 ; cobs, 1.76×10^4 to 2.0×10^4 ; grain 1.54×10^4 to 1.84×10^4 . These data indicate a considerable discrimination against cesium-137 on the basis of 1 N ammonium acetate soil extractions of these cations. The strontium-90—calcium ratios obtained in this calcareous soil varied with the mode of extraction of these cations. The range of variation compares favorably with that reported by other workers.

657 A/CONF.15/P/291

EFFECT OF RADIATION ON SALT UPTAKE IN PLANTS. D. A. Barber (Agricultural Research Council, Grove, Wantage, Berks, Eng.) and G. J. Neary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). 14p.

In plant nutritional experiments involving phosphate containing P^{32} as a radioactive tracer, there have been indications that the radiation emitted by the tracer may influence the uptake and distribution of salts. The radiation dose to the plant under such circumstances is, however, far from uniform and its estimation is uncertain. Experiments have therefore been carried out using precisely known doses from external sources of radiation. The uptake of Rb by suspensions of *Chlorella pyrenoidosa* from aerated 0.005 M solutions of RbCl containing tracer amounts of Rb^{86} was investigated at 30°C for periods of 1 hour. The Rb taken up was separated into fractions which exchanged readily with 0.01 M RbCl and which were non-exchangeable under the experimental conditions. This latter fraction would include ions that had undergone active transport. In no experiment was there any significant effect of radiation on the amount of the readily exchangeable ion fraction. During the period of Rb uptake 240-kv, x rays, and Co^{60} γ rays significantly decreased the amount of non-exchangeable ion taken up. Over the range of 50 to 300 r there was an increased effect with increasing dose with little further increase in effect over the range of 300 to 1000 r. It appeared that the effect was proportionally greater when the natural rate of salt uptake was small. When x rays were delivered immediately prior to the period of Rb uptake there was a significant increase in the amount of non-exchangeable salt taken up as compared with the unirradiated controls. This effect appeared to be dose dependent and not influenced by dose-rate. The stimulatory effect of x rays delivered prior to Rb uptake was shown to exhibit an oxygen effect stimulation by a given dose being much reduced by irradiation under anaerobic conditions. In common with many physiological effects of radiation, the stimulatory effect of x rays appears to be connected with the oxidation of sulphydryl groups

since pretreatment with sulphydryl inhibitors had a similar effect and the presence of cysteine prevented the stimulation caused by both x rays and sulphydryl inhibitors.

658

COMPARATIVE RATES OF ENTRY OF PHOSPHORUS-32 AND CALCIUM-45 AND THEIR MOBILITIES IN A PLANT AFTER EXTRARADICAL NUTRITION. G. V. Barinov. *Doklady Akad. Nauk S.S.S.R.* 125, 227-8 (1959). CA 53-20302c

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PECULIARITIES OF UPTAKE OF SUBSTANCES THROUGH LEAVES IN FOLIAR NUTRITION OF PLANTS. G. V. Barinov and E. I. Ratner (K.A. Timiryazev Inst. Plant Physiol., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rasteniy, Akad. Nauk S.S.S.R.* 6, 324-32 (1959). CA 53-18198b

660

THE EFFECTS OF HYDROXYLAMINE ON THE $C^{14}O_2$ FIXATION PATTERN DURING PHOTOSYNTHESIS. J. A. Bassham, M. Kirk, and M. Calvin. (Univ. of California, Berkeley). *Proc. Natl. Acad. Sci. U.S.A.* 44, 491-3 (1958). CA-52:18697g.

661

RELATIONSHIP OF CERTAIN MACROSCOPIC MARINE ALGAE TO Zn^{65} . Paul Harry Bedrosian (Univ. of Florida, Gainesville). *Dissertation Abstr.*, 22: 3146 (Mar. 1962).

A study of the radioactive decontamination capacity of macroscopic algae was undertaken. Three algae, *Gracilaria foliifera*, *Enteromorpha prolifera* and *Sphacelaria* sp. were subjected to various controlled conditions of light and temperature in uptake experiments employing sea water dosed with Zn^{65} . Temperatures ranged from 5 to 25°C with light intensity varying from about 1 to 500 foot-candles. In separate investigations employing similar variations of light and temperature, non-radioactive growth rate determinations of *Enteromorpha* and *Sphacelaria* were made in order to associate the effect of such growth upon the uptake. To determine the retention capacity of algae, radioactive contaminated *Sphacelaria* samples were placed in two aquaria, one of which contained ordinary undosed sea water, while the other contained stable-zinc-enriched, undosed sea water. A translocation experiment and algal autoradiographs were used to aid in the general explanation of the uptake mechanism. The uptake experiments indicated that about 500 foot-candles of light and temperatures ranging between the approximate limits of 18 and 25°C were most conducive to maximum uptake. Of the factors contributing to the uptake, the more significant ones were perhaps the ratio of the algae's surface area to weight and the number of photosynthetic pigments in the algae. It was found that *Sphacelaria* in undosed sea water retained its Zn^{65} concentration approximately 0.7 day for the adsorbed portion and about 240 days for the absorbed portion—in undosed, zinc-saturated, sea water, the retentions were respectively 0.4 day and 240 days. Autoradiograph studies showed that *Gracilaria*'s uptake was primarily one of absorption rather than adsorption. *Enteromorpha*'s uptake was also primarily attributed to absorption. The autoradiographs indicated further that fast growing fruiting bodies concentrated Zn^{65} more rapidly than other parts of *Gracilaria*. No detectable translocation of Zn^{65} was noted with the equipment or method used. Approximate maximum concentration factors

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for the algae investigated ranged from 1,200 to 13,000. These factors were fairly independent of the concentration of Zn^{65} present in the sea water. Macroscopic marine algae reduce the concentration of radioactive substances in sea water. Efficiency of this reduction is influenced by the number of accessory pigments contained by the algae and also by the organisms' surface-area-to-weight ratio. Some algae can be stimulated by chemical means to achieve their maximum concentration of Zn^{65} in a shorter time than normally required. By the same means they can be forced to release their concentrated Zn^{65} more quickly.

662 A/CONF.15/P/843

California. Univ., Berkeley. Radiation Lab.
EFFECT OF DEUTERIUM OXIDE (HEAVY WATER) ON BIOLOGICAL SYSTEMS. E. L. Bennett, M. Calvin, O. Holm-Hansen, A. M. Hughes, K. K. Lonberg-Holm, V. Moses, and B. M. Tolbert. 9p. (UCRL-3981). \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The effects of deuterium on growth, proton or deuterium uptake, and photosynthesis of algae are discussed. The effect of deuterium in prolonging the life of mice inoculated with tumors or leukemia, and the production of sterility in mice drinking D_2O are also discussed.

663 (TID-11114) INVESTIGATIONS OF PATHWAYS IN PLANT METABOLISM. Progress Report for the Period November 20, 1959–November 8, 1960. A. A. Benson (Pennsylvania State Univ., University Park). Nov. 5, 1960. 9p. Contract AT(30-1)-1876.

Neutron activation chromatographic analysis has been used widely for quantitative estimation of phosphatides in plant and animal tissues. Methods have been extended to include neutron activation of bromine-containing derivatives of organic compounds of metabolic significance. Sugars, carboxylic acids, and unsaturated fatty acids have been converted to derivatives containing bromine. Chromatography and neutron activation to give Br^{80} allows qualitative and quantitative analysis. The plant sulfolipid is recognized as a sulfolipid diglyceride. This chloroplast lipid, whose concentration approximates that of chlorophyll and exceeds that of most phosphatides, contains a sulfo-sugar. It is rapidly synthesized from either $C^{14}O_2$ or from $S^{35}O_4^{2-}$. Further isolation of sulfolipid glycerol has been carried out and the sulfo-sugar has been isolated by anion exchange resin chromatography. The formation of the $-CH_2-SO_3H$ structure constitutes an important aspect of carbohydrate metabolism in plants. The chemistry of aliphatic hydroxy sulfonic acids has received little attention. This study has been restricted by lack of fundamental chemical information. It has required synthesis of labeled sulfolipid aldehyde and sulfolipid aldehyde. It is apparent that these compounds are metabolized by plant cells. The physical and chemical properties of this family of compounds are being studied. Scintillation counting methods applicable in radiochromatographic studies were developed further. Plastic phosphors are used for counting C^{14} in chromatographic spots and in flowing effluents from exchange resin columns. The lipids of mitochondria were examined chromatographically. Plant mitochondria have phosphatidyl glycerol as the predominant lipid while chloroplasts contain much more of the galactosyl diglycerides. The characteristic lipid components of mitochondria were identified in pure monkey heart cell cultures.

664

PHOTOSYNTHESIS OF GALACTOLIPIDES. A. A. Benson, W. Wiser, R. A. Ferrari, and J. A. Miller. (Pennsylvania State Univ., University Park). *J. Am. Chem. Soc.* **80**, 4740(1958). CA-53:4442h.

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RADIOCHEMICAL IDENTIFICATION OF DIGLYCEROPHOSPHATE AND ITS PROBABLE ROLE IN LIPIDE SYNTHESIS BY PLANTS. A. A. Benson and B. Maruo (Pennsylvania State Univ., University Park). *Radioisotopes Sci. Research, Proc. Intern. Conf., Paris, 1957*, **4**, 510-19(Pub. 1958). CA 53-20262i

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EFFECT OF PREPLANTING IRRADIATION OF TUBERS WITH GAMMA RAYS OF Co-60 ON THE YIELD AND VITAMIN C CONTENT IN POTATOES. N. M. Berezina, G. I. Shchibria, V. V. Drozhzhina, R. R. Riza-Zade and A. D. Tarasova. *Radio-biologiya* **3**, 139-42(1963)

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EFFECT OF POTASSIUM CYANIDE ON APPARENT FREE SPACE IN A BROWN ALGA. P. L. Bergquist. (Univ. Auckland, N. Z.). *Nature* **181**, 1270 (1958). CA-52: 20368b.

668

SELECTIVE DESTRUCTION BY HEAVY NUCLEAR IRRADIATION OF THE CELL MEMBRANE IN INTER-NODAL CELLS OF NITELLOPSIS OBTUSA. R. M. Bergstrom, R. F. Blafeld, and M. W. Brenner. *Ann. Med. Exp. Fenn.* **40**(Suppl.1), 1-44(1962)

669

THE ABSORPTION AND TRANSLOCATION OF P^{32} IN PLANTS OF PHASEOLUS VULGARIS IN THE PRESENCE OF POLYETHYLENE GLYCOL AND INDOLE ACETIC ACID. E. Betto, R. Foa, and A. Volpi (Univ. of Milan). pp. 249-56 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A tracer study was made of the absorption and translocation of P in the presence of polyethylene glycol and indoleacetic acid. The results showed that the presence of glycol causes a better absorption and relative translocation of the phosphorus. The addition of indoleacetic acid causes no further increase in absorption or translocation. Separate studies confirmed that indoleacetic acid does not affect the absorption and translocation of phosphorus.

670

VARIATIONS IN THE ABSORPTION AND DISTRIBUTION OF PHOSPHORUS IN SINAPIS ALBA. STUDIED BY THE METHOD OF RADIOACTIVE PHOSPHORUS. I. VARIATIONS DURING PLANT DEVELOPMENT. G. Bfrnier. (Univ. Liege, Belg.). *Bull. soc. roy. sci. Liege* **26**, 341-53(1957). CA-52: 7436a.

671

CIRCULATION PATTERNS FOR PHOSPHORUS, SULFUR, AND CALCIUM IN THE BEAN PLANT. O. Biddulph, Susann Biddulph, R. Cory, and H. Koontz. (State Coll. of Washington, Pullman). *Plant Physiol.* **33**, 293-300(1958). CA-52: 20460a.

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PHOTOSYNTHESIS AND METABOLISM OF MARINE ALGAE. II. A SURVEY OF RATES AND PRODUCTS OF PHOTOSYNTHESIS IN C^{14} -CARBON DIOXIDE. R. G. S. Bidwell. (Atlantic Regional Lab., Halifax). Can. J. Botany **36**, 337-49(1958). CA-52: 12107b.

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PHOTOSYNTHESIS AND METABOLISM IN MARINE ALGAE. III. DISTRIBUTION OF PHOTOSYNTHETIC CARBON FROM C^{14} -CARBON DIOXIDE IN FUCUS VESICULOSUS. R. G. S. Bidwell, J. S. Craigie, and G. Krotkov. (Atlantic Regional Lab., Halifax). Can. J. Botany **36**, 581-90 (1958). CA-53:2381d.

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THE EFFECT OF IONIZING RAYS ON THE ENZYME ACTIVITY OF SUGAR BEET LEAVES. M. I. Bidzilya. Dopovidi Ukr. Akad. Sil's'kogospodar'k Nauk 1958, No. 4, 76-7; Referat. Zhur. Khim., Biol. Khim. 1959, Abstr. No. 3976. CA 53-15224b

675

THE EFFECT OF SULFUR-35 AND PHOSPHORUS-32 ON THE CHLOROPHYLL CONTENT OF PLANTS. M. I. Bidzilya. Dopovidi Ukr. Akad. Sil's'kogospodars'k Nauk 1958, No. 3, 7-10(Russian summary); Referat. Zhur. Khim., Biol. Khim. 1959, Abstr. No. 3975. CA 53-15224a

676

RADIATION SUCCULENCE. R. Biebl (Univ. of Vienna). Atompraxis **4**, 411-16(1958). (In German)

Chronic radiation with gamma rays of Co^{60} as well as single-dose x radiation in the first days of germination causes, from a certain dosage onwards, a succulence of the leaves in addition to various other morphological changes. The enlargement of the epidermis cells and decrease in the number of stomata per unit area connected with this, as well as the loosening of the leaf nervation, are characteristics which, from a purely morphological point of view, place "radiation succulence" closer to "salt succulence" than to "dry succulence." Possible connections are pointed out between the number of stomata and the increase in ascorbic acid content in the leaves which were observed following radiation.

677

INCREASE OF C^{14} IN THE ATMOSPHERE FROM ARTIFICIAL SOURCES MEASURED IN A CALIFORNIA TREE. George S. Bien and H. E. Suess (Scripps Institution of Oceanography, La Jolla). Z. Physik **154**, 172-4(1959).

The increase in the C^{14} content of the atmosphere was determined by a measurement of the increased activity in a Ponderosa Pine in California. To avoid affects from diffusion of organic material within the tree, the lignite was separated from the rest of the wood components. The results, after correction for differences in C^{13} concentration, showed a $10.49 \pm 0.2\%$ increase since 1953.

678

BIOCHEMICAL AND CHEMICAL STUDIES ON ASTRAGALUS LEAVES AND ROOTS. 1. ENZYMATIC; 2. TRANSLOCATION OF Se^{75} WITH RADIOAUTOGRAPHS; 3. ABSORPTION AND EXCHANGE OF Se^{75} IN ROOT

SEEDLINGS. Bulletin 385. (Wyoming. Agricultural Experiment Station, Laramie). 43p.

Studies on the enzymatic mechanism in respiration of the leaves of *Astragalus racemosus* suggest that the respiration is mediated by a cycle similar to, if not identical with, the Krebs citric acid cycle. Analysis of leaves, stems, and roots of *A. bisulcatus* grown in soil containing Se^{75} and K_2SeO_4 indicated that not all parts of the plant contain the same amount of Se. The roots, as they absorb Se from the soil, do not store it but translocate it to the aerial parts of the plant. Radioautographs of the leaves indicated that there is a definite relation between metabolic activity and presence of Se in the plant. A method for the fractionation of leaf protoplasm and chloroplasts was developed for *A. bisulcatus*. Factors influencing the separation are discussed. The distribution of Se^{75} indicated that Se does not occur in firm combinations with the proteins of the chloroplasts. Most of the Se^{75} was present in the cytoplasmic fractions. Root seedlings of *A. preussii* contained a high concentration of Se and absorption of radioactive Se was mainly through active absorption and ionic exchange for the Se present in the roots. Live roots at 25°C attained ionic equilibrium at a rapid rate. At 0°C both live and dead roots failed to establish equilibrium between the roots and the exchange solution. Live root skeleton bound more than 10% of the Se^{75} which was not acid extractable. About 1% of the Se^{75} was bound in the dead root skeleton, and this was not removed during extraction.

679

UPTAKE AND METABOLISM OF AMINO ACIDS BY SLICES OF CARROT. L. M. Birt and F. J. R. Hurd. (Univ. Melbourne). Biochem. J. **70**, 277-86(1958). CA-53: 1470e.

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THIOCTIC ACID AND PHOTOSYNTHETIC FIXATION OF CARBON DIOXIDE. B. B. Biswas and S. P. Sen. (Bose Inst., Calcutta). Nature **181**, 1219-20(1958). CA-52: 16484c.

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CARBON DIOXIDE UPTAKE STUDIES IN ALGAE GROWN IN WATER AND DEUTERIUM OXIDE. M. I. Blake, A. S. Kaganove, and J. J. Katz. J. Pharm. Sci. **51**, 375-9(1962) Apr.

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THE USE OF RADIOACTIVE TRACERS IN THE DETERMINATION OF THE WATER OF HYDRATION OF NATIVE CELLULOSE BY THE RESIDUAL METHOD. Bertrand Bloch. Compt. rend. **247**, 1601-4(1958). CA 53-9654i

683

UCRL-3848
California. Univ., Berkeley. Radiation Lab.
PHOTOSYNTHESIS. Melvin Calvin. July 1957. 32p.
Contract W-7405-eng-48. \$1.00(OTS).

The use of tracer carbon, as carbon-14, has made possible considerable progress in the mapping of the routes taken by the carbon atom from CO_2 into plant substances. The techniques of separation and identification that have made this progress possible lie largely in the region of chromatography and radioautography involving fractional gamma amounts of material. Most of the earlier steps of carbon incorporation are now known and will be described. In addition, a number of the later steps on the routes to amino acids and proteins and other plant substances are now under investigation. As a result of the recognition of

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the earlier stages of carbon incorporation, a number of proposals have been postulated about the photochemical act itself. These proposals have led to the development of direct physical tests of their validity and some results of these will be described. The remaining principal area of investigation involving the route of oxygen atoms from water to molecular oxygen is largely unexplored, but the use of new methods of analyzing for the heavy isotopes of oxygen may make more progress in this area possible.

684 A/CONF.15/P/2246

California. Univ., Berkeley. Radiation Lab.
PHOTOSYNTHESIS. Melvin Calvin, J. M. Anderson, James A. Bassham, U. Blass, O. Holm-Hansen, Vivian Moses, N. G. Pon, P. B. Sogo, and Gordon Tollin. 20p. \$0.50 (OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The oxygen pathway in photosynthesis was studied using O^{18} and an activation technique. High specific activity tritiated water was used to trace the path of hydrogen. These studies and carbon-14 studies of photosynthesis and electron spin resonance studies of primary quantum conversion in photosynthesis are summarized.

685

PHOSPHORUS ABSORPTION AND FIXATION IN VEGETABLES. IV. CONCOMITANT FIXATION OF PHOSPHORUS AND SULFUR IN VARIOUS PROTEIN FRACTIONS OF TISSUES IN RAPID GROWTH. Arturo Ceruti and Giuseppe Cetini. (Univ. Turin, Italy). *Atti accad. sci. Torino, Classe sci. fis. mat. e nat.* 91, 211-14(1956-57). CA-53: 2370e.

686

THE ABSORPTION AND TRANSPORT OF RADIO-ACTIVE CALCIUM, Ca^{45} , IN TOMATOES, A FIRST REPORT. Chin-Ching Chen and Yu-Yuen Yeh (National Taiwan Univ., Taiwan, [China]). Ho Tsu K'o Hsueh, 3: No. 2, 19-26(1961). (In Chinese)

The absorption and transport of calcium in tomatoes is studied hydroponically by using a Hoagland nutrient solution at half strength. Ca^{45} is used as the tracer. On account of the high temperature of the laboratory, transpirational loss of water is heavy, and the solution has to be checked every day and made up to strength. The "above ground" parts, particularly the leaves, are bathed with the same nutrient solution to see if absorption also takes place and, if absorbed, the direction of transport. The results indicate ready absorption of calcium by all parts of the plant but transport is essentially unidirectional.

687

THE GROWTH OF ALGAE IN D_2O DEUTERIUM OXIDE. William Chorney, Norbert J. Scully, Henry L. Crespi, and Joseph J. Katz (Argonne National Lab., Ill.). *Biochim. et Biophys. Acta*, 37: 280-7(Jan. 15, 1960). (In English)

The experiments described indicate that algae grow and divide in a medium containing more than 99% D_2O . After an inhibition period both *Chlorella* and *Scenedesmus* grew and divided, and after growth was established showed only a small percentage of abnormally large cells. The development of improved nutrient media for deuterated organisms is discussed. Deuterated compounds other than sugars were isolated from algae. It may be possible to use deuterated algae as such as a substrate for the growth of organisms

that would give high yields of specific compounds such as amino acids, nucleic acids, and antibiotics. Simultaneous labeling with C^{14} could also be accomplished. With the successful culture of algae in deuterated media the way is open for a considerable variety of experiments involving deuterium and its biological effects.

688 ACCUMULATION OF POTASSIUM, CESIUM¹³⁷, AND RUBIDIUM⁸⁶ IN BEAN PLANTS GROWN IN NUTRIENT SOLUTIONS. J. F. Cline and F. P. Hungate (General Electric Co., Richland, Wash.). *Plant Physiol.* 35, 826-9 (1960) Nov. (HW-SA-1841).

By the addition of potassium to the nutrient substrate, Cs^{137} and Rb^{86} uptake by bean plants was reduced less than expected from an assumed physiological equivalence of these ions. Plants discriminated against cesium at low potassium nutrient concentrations; but with increasing substrate potassium, this discrimination diminished. Discrimination of Rb^{86} from potassium approximated that observed for Cs^{137} . Potential errors from the use of ratios in predicting uptake of Cs^{137} were discussed. Some toxicity was noted when significant quantities of nonradioactive cesium were in the nutrient solution.

689 EFFECT OF NUTRIENT POTASSIUM ON THE UPTAKE OF CAESIUM-137 AND POTASSIUM AND ON DISCRIMINATION FACTOR. J. F. Cline (General Electric Co., Richland, Wash.). *Nature*, 193: 1302-3(Mar. 31, 1962). (HW-SA-2360)

Five-day-old red kidney bean seedlings were grown for 16 days in solutions containing 0.02 to 30 mM K and 1 μ c/l Cs^{137} . At harvest, the roots, stems, and old and new leaves were analyzed for K and Cs^{137} . The results do not indicate either a constant Cs^{137} uptake or a constant discrimination factor (Cs^{137}/K ratio). Increase of the K level in the solution resulted in a fairly uniform increase in the K content of the plant tissues, but this increase was not proportional. The uptake of Cs^{137} was generally reduced by increased K, but the change was not uniform. The discrimination factor varied 6-fold in roots, 40-fold in stems, and 100-fold in leaves as solution K varied 2000-fold (0.02 to 30 mM). It is concluded that there is no valid reason for using ratios of K and Cs^{137} for food hazards evaluation.

690 (HW-72500(p.134-8)) EFFECT OF NUTRIENT POTASSIUM AND CESIUM ON UPTAKE OF CESIUM-137 BY PLANTS. J. F. Cline (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Accumulation of Cs^{137} was largely independent of potassium concentrations, indicating that discrimination by plants of these two elements changes. Cesium toxicity and factors affecting severity of toxicity are described. Visual toxicity was observed when potassium and cesium approached equal concentrations in the substrate.

691 HW-59500(p.87-9)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECT OF SOIL TYPE AND SOIL PLACEMENT OF Zn^{65} ON UPTAKE BY PLANTS. J. F. Cline. 3p.

Movement of Zn^{65} in calcareous soil was slight under all conditions tested. Zn^{65} stratified in this soil was nearly equally available to the plant at all positions tested. In acid soil movement of Zn^{65} was increased by presence of exchangeable ions in the eluting solution

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and stratification affected the amount of Zn^{65} taken up by plants.

692 (HW-65500(p.34-6)) POTASSIUM, CESIUM-137, AND RUBIDIUM-86 RELATIONSHIPS IN PLANTS AND SOIL. J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Addition of potassium to the nutrient substrate reduced Cs^{137} and Rb^{86} uptake by plants, but less than expected from an assumed physiological equivalence of the ions. Discrimination between Cs^{137} -K or Rb^{86} -K varied with the concentration of potassium in the substrate. Cesium-137 was not moved appreciably through soil columns by water. Fifty per cent was leached from acid soil columns with 0.1 N KCl, but none was removed from alkaline soil. Flooding did not increase Cs^{137} uptake by rice plants over that observed when soil was not flooded.

693 HW-62037
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

POTASSIUM, CESIUM-137 AND RUBIDIUM-86 RELATIONSHIPS IN PLANT UPTAKE, SOIL DIFFUSION RATES AND IRRIGATION PRACTICES. J. F. Cline. May 24, 1960. 12p. Contract AT(45-1)-1350. OTS.

Addition of potassium to the nutrient substrate reduced Cs^{137} and Rb^{86} uptake by plants, but less than expected from an assumed physiological equivalence of the ions. Discrimination between Cs^{137} -K or Rb^{86} -K varied with the concentration of potassium in the substrate. Cs^{137} was not moved appreciably through soil columns by water. Fifty per cent was leached from acid soil columns with 0.1 N KCl, but none was removed from alkaline soil. Flooding did not increase Cs^{137} uptake by rice plants over that observed when soil was not flooded.

694
EFFECT OF VARIOUS FORMS OF NITROGEN ON COMPOSITION OF LABELED PRODUCTS OF PHOTOSYNTHESIS IN CORN AND BEANS. N. G. Doman and S. G. Vakiinova. Doklady Akad. Nauk S.S.S.R. 122, 653-6(1958). CA-53:2373e.

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INTERRELATION BETWEEN PHOTOSYNTHESIS AND RESPIRATION IN PLANTS. N. G. Doman (Inst. Biochem., Acad. Sci. U.S.-S.R., Moscow). Biokhimiya 24, 19-24(1959). CA 53-11534b

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OXIDATIVE PHOSPHORYLATION OF MITOCHONDRIA OF PEAS STUDIED WITH PHOSPHORUS-32. G. Ducet. (Plant physiol. Sta., Versailles, France) and J. Rosenberg. Ann. inst. natl. recherche agron., Ser. A, Ann. agron., Ser. A, Ann. agron., Physiol. veg. 2, 23-33 (1958). CA-53:5429d.

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FATE OF ATOMS OF THE ARGININE MOLECULE IN THE COURSE OF ITS DEGRADATION BY JERUSALEM ARTICHOKE TISSUES. Henri Duranton. Compt. rend. 246, 3095-8(1958). CA-52: 20421e.

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FATE OF ATOMS OF AMIDINE GROUP OF ARGININE DURING DEGRADATION IN TISSUES OF JERUSALEM ARTICHOKE. Henri Duranton. Compt. rend. 247, 502-4(1958). CA-53:3398a.

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METABOLISM OF CHLOROPHYLL PIGMENTS IN TOBACCO. Jacques Duranton, Jean Michel Galmiche, and Eugene Roux. (Serv. biol., C.E.N., Saclay, France). Compt. rend 246, 992-5(1958). CA-52: 10299a.

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INTRODUCTION OF RADIOACTIVE SOLUTIONS INTO TREES AND SHRUBS. R. P. Ealy. Oklahoma Agr. Expt. Sta. Tech. Publ. No. 70, (1957). 4p.

A technique is described for introducing radioactive solutions into the tap root of young trees and shrubs.

701

INCORPORATION OF CARBON-14 OR PHOSPHORUS-32 INTO THE PHOSPHATIDES OF RUNNER BEAN ~~XXXXXXXX~~ LEAVES. Frank M. Eberhardt and Morris Kates. (Natl. Research Labs., Ottawa). Can. J. Botany 35, 907-21(1957). CA-52-3051e.

702

EFFLUX AND RETENTION OF FOLIAR APPLIED PHOSPHORUS-32 AND SULFUR-35 BY INTACT BEAN ROOTS, AND THE INFLUENCE OF VARIOUS AMBIENT IONS ON THIS RELATIONSHIP. Fred H. Emmert (Univ. of Connecticut, Storrs). Plant and Soil, 14: No. 1, 33-42(Mar. 1961).

Tests were conducted to learn more about the quantitative aspects of efflux from intact plant roots and of possible influences of ion species in the recipient solutions on the process. Tests involved foliar introduction of P^{32} and S^{35} to bean plants and measurement of loss of isotope from roots to various single salt solutions. Comparisons were made of fraction lost as opposed to the fraction retained by the root. Both P^{32} and S^{35} were found to pass from bean root to surrounding solutions under all experimental conditions, however, less than 1% of what was in the root was lost. The process of exit of isotopes from roots was conditioned by composition of the surrounding medium. Data are tabulated.

703

EVIDENCE OF A BARRIER TO LATERAL PENETRATION OF P-32 ACROSS ROOTS OF INTACT TRANSPIRING PLANTS, BASED ON MEASUREMENTS OF XYLEM STREAM COMPOSITION. Fred H. Emmert (Univ. of Connecticut, Storrs). Physiol. Plantarum, 14: 478-87(1961). (In English)

Quantitative aspects of lateral penetration of P^{32} across roots of intact transpiring bean plants were investigated by measuring isotope which reached the xylem stream. Plants were grown to treatment size under controlled environment and nutrient conditions, and were then placed in a treatment solution containing P^{32} . Isotope which appeared in petiole, epicotyl, and hypocotyl samples over a 20 minute period was measured. Xylem stream P^{32} was at least partially separated from the metabolic fraction by subjecting only the sample to low temperature. Time course buildup of P^{32} in test samples following a distinct two-phase pattern. The first phase was an abrupt rise in sample activity 2 to 4 min following root introduction of isotope. This rise was not sensitive to sample temperature, and was attributed to initial passage of the isotope front through the samples. Buildup which occurred in the post 4 min period was in part sensitive to sample temperature. Reductions which occurred as a result of 3°C sample temperature were believed to represent isotope metabolically accumulated within the sample. Remaining activity was attributed to isotope in the xylem stream and

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to an unknown "X" fraction. Xylem volume of test samples was determined. Calculations were then made of activities which could be expected in the time course studies had composition of the ingoing stream not changed with respect to P-32. Results indicated that the bulk of P-32 was removed from the ingoing stream before reaching the test samples. The rapidity and efficiency with which the isotope was removed from the stream indicated that functional depletion was not the primary process involved. Suggestion was made of a specific barrier to transpiration passage of P³² across the root.

704 (TID-16380) EFFECT OF CHELATING AGENTS ON THE UPTAKE OF Y⁹¹, Rh¹⁰⁶, Ce¹⁴⁴, AND Pm¹⁴⁷ BY BEANS GROWN IN A CALCAREOUS SOIL. E. Essington, H. Nishita, and A. Wallace (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). July 1962. Contract AT(04-1)-Gen-12. 28p.

The influence of cyclohexane-1,2-diaminetetraacetic acid (CDTA), diethylenetriaminepentaacetic acid (DTPA), and ethylenediamine di(o-hydroxyphenylacetic acid) (EDDHA) on the uptake of Y⁹¹, Ru¹⁰⁶, Ce¹⁴⁴, and Pm¹⁴⁷ by bean plants grown in a calcareous soil was studied. DTPA greatly increased the amount of Y⁹¹, Ce¹⁴⁴, and Pm¹⁴⁷ accumulated in plant parts, especially the leaves. CDTA increased the Y⁹¹ and Pm¹⁴⁷ uptake but the uptake of Ce¹⁴⁴ was affected only slightly. EDDHA slightly increased the Y⁹¹ and Pm¹⁴⁷ accumulation in the leaves but did not affect that of Ce¹⁴⁴. In general, the three chelates did not significantly affect the uptake of Ru¹⁰⁶ by plants. Application of chelating agents to the soil did not significantly change the dry weight yield of the plants. Paper chromatography of leaf extract indicated that Y⁹¹-DTPA complex was present in the leaves of bean plants grown in a soil treated with Y⁹¹ and DTPA. This indicated that Y⁹¹-DTPA complex may have been translocated from the roots to the leaves.

705 THE EFFECT OF METABOLISM ON THE TRANSPORT OF ¹⁵O-LABELLED OXYGEN THROUGH *VICIA FABA* ROOTS. N. T. S. Evans and M. Ebert (Hammer-smith Hospital, London). Intern. J. Radiation Biol., 3: 627-36(Nov. 1961). (In English)

The transport of oxygen through continuous gas spaces in the root of the seedling of *Vicia faba* was investigated, using coincidence-counting of labelled nitrogen-oxygen gas mixtures containing 19% and 0.4% oxygen. The observations indicate that, in diffusing to the elongating zone and the radiosensitive root meristem, a little oxygen is lost to the tissue. This loss occurs in the region of the cotyledon and hypocotyl.

706 RADIOISOTOPES IN SCIENTIFIC RESEARCH. VOLUME IV. RESEARCH WITH RADIOISOTOPES IN PLANT BIOLOGY AND SOME GENERAL PROBLEMS. Proceedings of the International Conference held in Paris in September 1957 under the Auspices of the United Nations Educational Scientific and Cultural Organization. R. C. Extermann, ed. New York, Pergamon Press, 1958. 708p.

Fifty-two papers are presented. Topics covered include applications of radioisotopes in studies on mineral metabolism in plants, translocation in plants, plant biosynthesis, and plant metabolism. Methods are discussed for measuring activity from carbon-14 used as a tracer. Results are included from tracer studies on the solu-

bility of calcium carbonate in ocean waters, the movement of radioactive phosphorus from the mud of lakes, and metabolism in zooplankton. A complete subject index is included.

707 ABSORPTION, TRANSLOCATION, AND METABOLISM OF 2,4-D-1-C¹⁴ IN PEA AND TOMATO PLANTS. S. C. Fang. (Oregon Agr. Expt. Sta., Corvallis). *Weeds* 6, 179-86(1958). CA-52: 20418f.

708 M-7123
Department of Agriculture.
FIELD TRIAL OF TREATMENTS AFFECTING STRONTIUM UPTAKE. [1954]. 8p. \$1.80(ph), \$1.80(mf) OTS.

The uptake of strontium-89 by soybeans and blue-grass was measured following artificial contamination of the soil surface in a field experiment. The effects of various combinations of tillage treatments and additions of lime on this uptake were determined. The uptake of calcium by the crops was determined, and the ratios of strontium-89 to calcium were calculated for the soil and crops. Data are tabulated.

709 NUCLEIC ACIDS IN SOME DEUTERATED GREEN ALGAE. E. Flaumenhaft, S. M. Conrad and J. J. Katz. *Science* 132, 892-4(1960) Sept. 30.

710 RDB(W)/TN-187
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England. THE UPTAKE OF ZIRCONIUM⁹⁵ AND NIOBIUM⁹⁵ BY PORPHYRA SP. E. E. Foreman and W. L. Templeton. Feb. 1955. 15p.

Experiments carried out on the uptake of Zr⁹⁵ and Nb⁹⁵ by the edible seaweed, *Porphyra umbilicalis*, show that when the activity of the seawater is maintained at a constant level of 8.65×10^{-3} μ c/ml, concentration factors of 336 for zirconium and 435 for niobium are reached after 34 days. With the water activity constant at the lower level of 9.5×10^{-4} μ c/ml, the concentration factors for zirconium are 200 after 34 days and 230 after 73 days, and for niobium 420 after 34 days and 470 after 73 days. The release of zirconium and niobium was studied by placing drums of activated weed on the shore. Fifty per cent of the activity is lost after 6 days and 96 per cent after 65 days. The mode of uptake and methods of analysis are discussed.

711 INCORPORATION OF CARBON-14-LABELED SUBSTRATES INTO THE AMINO ACIDS OF GROUNDNUT PLANTS (*ARACHIS HYPOGAEA*). L. Fowden and J. A. Webb. *Ann. Botany* 22, 73-93(1958). CA-52: 10294d.

712 CAROTENOID BIOSYNTHESIS IN TOMATOES. F. J. Francis. (Univ. of Massachusetts, Amherst). *Proc. Am. Soc. Hort. Sci.* 71, 349-55(1958). CA-52: 18692i.

713 DIRECT INCORPORATION OF MOLECULAR OXYGEN INTO ORGANIC MATERIAL BY RESPIRING CORN SEEDLINGS. G. J. Fritz, Wilmer G. Miller, R. H. Burris, and Laurens Anderson. (Pennsylvania State Univ., University Park).

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REDUCTION OF SULFATE TO SULFITE BY TOBACCO LEAVES. P. Fromageot and H. Perez-Milan (Serv. biol. comm. energie at., Gif-sur-Yvette, France). Biochim. et Biophys. Acta 32, 457-64(1959) (in French). CA 53-15228b
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CARBON METABOLISM IN THE HIGHER PLANTS. II. STRUCTURAL DISTRIBUTION OF THE CARBON-14 ABSORBED THROUGH THE LEAF IN THE RICE PLANT. Akio Fujiwara and Michio Suzuki. (Tohoku Univ., Sendai). Tohoku J. Agr. Research 8, 89-94(1957). CA-52: 20424a.
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PTERIDINES IN PHOTOSYNTHESIS. R. C. Fuller, I. C. Anderson, and H. A. Nathan. (Brookhaven Natl. Lab., Upton, N.Y.). Proc. Natl. Acad. Sci. U.S. 44, 239-44(1958). CA-52: 13887i.
- 717** TID-7554(p.475-86)
Brookhaven National Lab., Upton, N. Y.
USE OF ISOTOPES IN PLANT BIOCHEMISTRY. R. C. Fuller. p.475-86 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 12p.
Applications of carbon-14 in studies of plant biochemistry are reviewed. The uses of oxygen-18, sulfur-35, and tritium in studies on photosynthesis and plant metabolism are discussed.
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DETERMINATION OF RADIOSTRONTIUM AND RADIOCESIUM IN THE SOIL AND PLANTS. P. Gaglione, A. Malvicini and Vidol. Minerva Nucl. 4, 155-61(1960) June
- 719**
RESPONSE OF THE YOUNG TOMATO PLANT TO A BRIEF PERIOD OF WATER SHORTAGE. IV. EFFECTS OF WATER STRESS ON THE RIBONUCLEIC ACID METABOLISM OF TOMATO LEAVES. C. T. Gates and James Bonner. (California Inst. of Technol., Pasadena). Plant Physiol. 34, 49-55(1959). CA-53:6363c.
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ROOT SECRETIONS AND PLANT NUTRITION. I. A. Geller and D. A. Tabentskii. Doklady Akad. Nauk S.S.S.R. 115, 389-91(1957). CA52-3930d.
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ASYMMETRIC DISTRIBUTION OF CARBON-14 IN SUGARS FORMED DURING PHOTOSYNTHESIS. Martin Gibbs and Otto Kandler. (Brookhaven Natl. Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 43, 446-51(1957). CA-52: 16490i.
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THE RELATION BETWEEN THE ABSORPTION SPECTRUM AND THE INTENSITY OF PHOTOSYNTHESIS IN THE RED ALGA RHODOSORUS MARINUS. Georges Giraud. Compt. rend. 248, 277-80(1959). CA 53-11525e
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REACTION OF TRANSFORMATION OF PROTOCHLOROPHYLL INTO CHLOROPHYLL. T. N. Godnev, A. A. Shlyk, and Ya. P. Lyakhnovich. (Biol. Inst., Minsk). Fiziol. Rastenii 4, 393-6(1957). CA-52-4755b.
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THE RaD CONTENT OF PLANTS OBTAINED BY A γ SPECTROSCOPIC METHOD. K. J. Godt and K. Sommermeyer (Universität Freiburg/Breisgau, Ger.). Atomkern-energie 5, 282-5(1960) July-Aug. (In German)
The various kinds of radioactive compounds in plants are not only of interest from the science point of view but its knowledge is also required for critical judgment of questions regarding radiation protection. The RaD-content in plants, after all, is quite considerable as it can be measured by gamma-spectrographical methods, whereby the 46.5 kev-line can be regarded as proof.
- 725**
MODES OF ENTRY OF STRONTIUM INTO PLANT ROOTS. Juan de Dios Lopez Gonzalez and Hans Jenny (Universidad de Granada and Junta de Energia Nuclear, Spain and Univ. of California, Berkeley). Science 128, 90-1(1958) July 11.
Data are summarized from a series of experiments on the modes of entry of strontium into plant roots. Strontium-85 was used as a tracer.
- 726**
INCORPORATION OF C¹⁴-CARBON DIOXIDE, ACETATE-2-C¹⁴ ACID INTO β -CAROTENE IN ETIOLATED MAIZE SEEDLINGS. T. W. Goodwin. (Univ. Liverpool, Engl.). Biochem. J. 69, 26P-27P (1958). CA-53: 502d.
- 727** A/CONF.15/P/1646
CYTOCHEMICAL STUDIES OF NUCLEAR METABOLISM IN BIOLOGICAL SYSTEMS. A. R. Gopal-Ahengar (Atomic Energy Establishment. Trombay, India). 6p.
With the aid of track autoradiography using an electron sensitive liquid emulsion it was possible to follow the intracellular incorporation of a labelled precursor like adenine-8-C¹⁴ which is specific for nucleic acids. The incorporation was determined on the basis of the topographical emission of ionizing particles in particular organelles of the cell. The balance of evidence points to the fact that in oocytes of the newt. the nucleolus incorporates adenine with marked rapidity in the RNA. However, the fact that there is a high specific radioactivity in the nucleolus does not necessarily imply that the site of synthesis of RNA is centered in this intranuclear structure. since in the actively dividing meristematic cells of *Vicia faba* there is a preferential uptake of the labelled adenine in the heterochromatic and nucleolar organizing (SAT) regions of the long chromosomes. From this it would appear that the nucleolus acts as a reservoir of RNA and that actual synthesis supervenes in the heterochromatic regions and SAT-loci of particular chromosomes. In an attempt to understand the mechanics of chromosome replication, cytologists have made many assumptions. the validity of which has not been tested on cytochemical grounds until very recently. Although it has been known for long that during mitosis there is a doubling of chromosomes followed by an equipartition of chromosomal substance between the two daughter nuclei, no decisive technique has so far

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demonstrated whether the original chromosome produces by a self-duplicating process a replica of itself from available new material or whether the original chromosomal substance is equally distributed between the daughter nuclei. However, with the availability of specific precursors, like thymidine-2-C¹⁴ of DNA and refinement in autoradiographic techniques it is now possible to selectively label particular components of chromosomes and follow the fate of the tagged atoms in successive mitotic cycles. In this way evidence is accumulating to suggest the operation of a template process in chromosome synthesis and duplication, at any rate in the somatic mitoses of *Vicia faba* and *Luzula* species. The cytological implications of such a synthesis are further discussed.

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CELLULOSE DEPOSITION OF ELONGATING EPIDERMAL CELLS OF AVENA COLEOPTILES. P. R. Gorham and J. R. Colvin. (Nat'l. Research Labs., Ottawa, Can.). Exptl. Cell Research **13**, 187-9(1957). CA-52: 16494e.

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EFFECTS OF BICARBONATE AND SOME OTHER ANIONS ON THE SHOOT CONTENT OF PHOSPHORUS-32, CALCIUM-45, IRON-59, RUBIDIUM-86, STRONTIUM-90, RUTHENIUM-106, CESIUM-137, AND CERIUM-144 IN BEAN AND BARLEY PLANTS. James A. Goss and E. M. Romney (Univ. of California, Los Angeles). Plant and Soil **10**, 233-41(1959). CA 53-15218b

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BIOSYNTHESIS OF GLYCOLATE AND RELATED COMPOUNDS FROM RIBOSE-1-C¹⁴ IN TOBACCO LEAVES. Thomas Griffith and Richard U. Byerrum (Michigan State Univ., East Lansing). J. Biol. Chem. **234**, 762-4(1959). CA 53-13292i

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NP-tr-4
SUPPLY OF RADIOACTIVE ISOTOPES TO THE PLANT BY WAY OF THE LEAVES. I. V. Gulyakin and E. V. Yudinseva. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. **111**, 709-12(1956). 8p.

732

A/CONF.15/P/2311
UPTAKE OF STRONTIUM, CESIUM AND SOME OTHER FISSION PRODUCTS BY PLANTS AND THEIR ACCUMULATION IN CROP YIELD. I. V. Gulyakin and E. V. Yudinseva (U.S.S.R.). 25p.

The results of investigations conducted by the authors on the uptake of strontium-90, cesium-137, cerium-144, zirconium-95, ruthenium-106, and some other fission products by various agricultural plants summarized. Data on the distribution of the elements in plants and their accumulation in different parts of the crop plants as a function of biological characteristics of the plant environmental conditions are given. Possible agrochemical and agrotechnical aspects of the problem of controlling processes responsible for the amount of fission products accumulated and the ratio between strontium and calcium, and cesium and potassium in crop plants are considered. The results of the investigations show that the accumulation of radioactive fission products during the vegetative period increases with the growth of the above-ground mass of the plant. Reproductive organs of plant accumulate radioisotopes of

strontium and cesium in greater amount than other fission products. Data are tabulated.

733

A/CONF.15/P/2233
RHYTHMICITY IN THE ABSORPTION AND ELIMINATION ACTIVITY OF THE ROOTS. I. I. Gunar, E. E. Krastina, and A. E. Petrov-Spiridonov (K. A. Timiriasev Agricultural Academy, Moscow). 41p.

Rhythmical alterations of physiological processes in the root systems of plants were established with the aid of tracer techniques employing phosphorus-32 labeled phosphates, sulfur-35 labeled sulfates, and potassium and calcium determined by polarographic methods. Factors influencing the rhythmic pattern are discussed.

734

ISOTOPE EXPERIMENTS ON THE 2,6-DICHLOROPHENOLINDOPHENOL-MEDIATED OXIDATION OF ASCORBIC ACID BY ILLUMINATED CHLOROPLASTS. Helen M. Habermann and Leo P. Vernon (Univ. of Chicago and Brigham Young Univ., Provo, Utah). Arch. Biochem. Biophys. **76**, 424-9(1958) Aug.

The use of oxygen isotopes revealed that when 2,6-dichlorophenolindophenol and ascorbic acid were added to a system containing illuminated *Phytolacca* chloroplasts functioning in a Mehler reaction, the rate of oxygen evolution was decreased to $\frac{9}{10}$ while the rate of oxygen consumption was increased to $2\frac{3}{4}$ times the original rates. After complete oxidation of the added ascorbate, the rate of oxygen evolution increased to $1\frac{1}{2}$ times the original rate. These results support the assumption that ascorbate can be oxidized via the (OH) system produced by the photolysis of water.

735

A/CONF.15/P/1058
Department of Agriculture. Mineral Nutrition Lab., Beltsville, Md.

THE FUNCTION OF OXIDATIVE METABOLISM IN THE PASSAGE OF IONS INTO PLANTS. Cal E. Hagen and Sterling B. Hendricks. 8p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The cellular accumulation of phosphate as followed with phosphorus-32 tracer is shown to take place through sites coupled with oxidative phosphorylation in respiration.

736

THE ROLE OF NITROGEN RESERVES IN NEW GROWTH OF APPLE AND THE TRANSPORT OF PHOSPHORUS-32 FROM ROOTS TO LEAVES DURING EARLY SPRING GROWTH. C. P. Harley, L. O. Regeimbal, and H. H. Moon (U.S. Dept. of Agr., Beltsville, Md.). Proc. Am. Soc. Hort. Sci. **72**, 57-63(1958). CA 53-9387h

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ABSORPTION OF RADIOACTIVE SULFUR BY THE FRUIT SYSTEM IN COMPARISON TO THE ROOTS OF PEANUTS. Henry C. Harris (Univ. of Florida, Gainesville). Proc. Intern. Conf. Peaceful Uses At. Energy, Geneva, 1955, **12**, 203-7(1956). CA 53-9383d

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PHYSIOLOGICAL STUDIES ON INEFFECTIVE TILLERS IN RICE, WHEAT, AND BARLEY PLANTS. I. EFFECT OF THE SMALL TILLERS ON THE RIPENING OF FRUITFUL STEMS IN WHEAT PLANTS. II. THE RELATION BETWEEN WEAK AND STRONG TILLERS AT THE STAGE OF VEGETATIVE GROWTH IN WHEAT

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ON THE CAPTURE EFFECT AND FILTER EFFECT OF VEGETATION FOR VOLATILE RADIOIODINE. W. Herbst. Strahlentherapie 116, 420-5 (1961) Nov.
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LEAD-210 AND POLONIUM-210 IN GRASS. C. R. Hill (Royal Cancer Hospital, London). Nature 187, 211-12 (1960) July 16.
Evidence is presented that suggests that a large part of the alpha activity observed in certain samples of grass may originate as a decay product of atmospheric radon which is deposited onto the grass by rainfall. Results are reported from measurements of alpha activity of samples of grass and soil collected in the southern part of Great Britain. Measurements were also made on tissues from lambs from the same region. Polonium-210 was found concentrated in the kidney. Observations of the decay of total alpha activity indicated that polonium-210 occurs in the absence of lead-210.
- 741**
EFFECT OF HYDROGEN PEROXIDE ON THE LIGHT-INDUCED CAPACITY OF CARBON DIOXIDE-FIXATION IN GREEN ALGAE. Toyoyasu Hirokawa, Shigetoh Miyachi, and Hiroshi Tamiya (Tokugawa Inst. Biol. Research, Tokyo). J. Biochem. (Tokyo) 45, 1005-10(1958). CA 53-8308d
- 742** AEC-tr-3076
EXPERIMENTAL DETERMINATION OF URANIUM IN LIVING FRESH-WATER ALGAE. (Experimentelle Erfassung von Uran in Lebenden Süsswasseralgen). Josef Hoffmann. Translated by W. H. Everhardy from Naturwissenschaften 29, 403-4(1941). 6p.
- 743**
RESPIRATION AND THE OXIDATIVE ACTIVITY OF PARTICULATE FRACTIONS FROM DEVELOPING PEPPER FRUITS (CAPSICUM ANNUUM). F. D. Howard and M. Yamaguchi. (Univ. of California, Davis). Plant Physiol. 32, 418-23(1957). CA-52-3938b.
- 744** (HW-63173) DECONTAMINATION OF PLANTS EXPOSED TO A SIMULATED REACTOR BURN. F. P. Hungate, J. D. Stewart, R. L. Uhler, and J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 1, 1960. 18p. Contract AT(45-1)-1350. OTS.
A variety of plants was exposed to the products of a melted fuel element in a simulated reactor burn. Leaves were then washed in laboratory tests to determine percentage removal of I^{131} , $Ru^{103,106}$, and Cs^{137} . From 60 to 90% of the I^{131} was removed. Distilled water was least effective and a household detergent was most effective as a decontaminating agent. By surface stripping, it was shown that less than 10% of the I^{131} was in the mesophyll tissue of leaves. Autoradiograms showed some distinct hot spots, presumed to be particulate, but also showed a diffuse deposit of activity on the leaves with a heavier concentration at the leaf margins. Since this marginal activity could be removed by plastic coatings, it was concluded to have resulted from dynamics of deposition rather than to transport within the leaf.
- 745** (HW-65500(p.85-90)) I^{131} REMOVAL FROM LEAVES. F. P. Hungate, J. D. Stewart, R. L. Uhler, and J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
The relative efficiencies of various agents in decontaminating leaves exposed to air-borne products from a melted fuel element are reported.
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SYNTHESIS OF PHLORIN AND OTHER PHENOLIC GLUCOSIDES BY PLANT TISSUES. A. Hutchinson, Chitra Roy, and G. H. N. Towers. (McGill Univ., Montreal, Can.). Nature 181, 841-2 (1958). CA-52: 13896g.
- 747** EVALUATION OF THE ORIGINS OF STRONTIUM-90 CONTAINED IN WHEAT PLANT. Ryushi Ichikawa, Michiko Abe, and Masako Eto (National Inst. of Radiological Sciences, Chiba City, Japan). Science, 133: 2017-8(June 23, 1961).
Twenty percent of the strontium-90 in wheat flour in 1959 was due to root absorption, 30% was due to floral absorption from soil particles attached to the ear, and 50% was due to current fall-out. In 1960, 35% was due to root absorption, 50% to floral absorption from soil, and 15% to current fall-out.
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STRONTIUM-90 AND CESIUM-137 ABSORBED BY RICE PLANTS IN JAPAN, 1960. R. Ichikawa, M. Eto, and M. Abe. Science 135, 1072(1962) Mar.
- 749**
PHYTOCHEMICAL INVESTIGATION ON CULTIVATION OF MEDICINAL PLANTS. XIII. ALKALOID BIOGENESIS IN DATURA. 3. Izumi Imaseki. (Univ. Tokyo). Pharm. Bull. (Tokyo) 5, 447-51(1957). CA-52: 82851.
- 750** ISOTOPES IN SOIL-PLANT NUTRITION STUDIES. Intern. At. Energy Agency Bull., 4: No. 3, 10-13(July 1962).
A summary is given of papers and discussions presented at the Symposium on Use of Radioisotopes in Soil-Plant Nutrition Studies in Bombay on Feb. 26 to March 2, 1962. Some of the topics discussed were soil chemistry, physical characteristics of soil, uptake and translocation of nutrients, measurement of available phosphorus, and fertilizer usage.
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AMINO ACIDS AND PROTEIN SYNTHESIS IN LEAVES OF THE BEAN PLANT. Shtefan Ivanko. Sbornik Stud. Nauch.-Issledovatel. Rabot Moskov. Sel'skokhoz. Akad. im. K. A. Timiryazeva 1958, No. 8, 171-8. CA-53: 1475g.
- 752** CAESIUM-137 LABELLED ALGAE FOR FILTRATION STUDIES. K. J. Ives (University Coll., London). Intern. J. Appl. Radiation and Isotopes, 9: 49-53(Dec. 1960). (In English)
A method is described whereby the green algae *Chlorella* and *Scenedesmus* were cultured in a growth medium containing Cs^{137} . These radioactive algae were used as a suspension in water passing through a column of filter sand. The distributions of the algal cells retained in the filter

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were measured with a scintillation counter mounted externally to the column. Calibrations of the shielded scintillation counter for the amount of activity per algal cell and for the geometry of the filter column are described.

753

MEASUREMENT BY THE CARBON-14-METHOD OF THE PHOTOSYNTHETIC ACTIVITY OF SOME WATER MASSES OF THE SOUTHWEST PACIFIC IN RELATION TO THE STUDY OF THE FERTILITY OF THESE WATERS. H. R. Jitts and H. Rotschi. Radioisotopes Sci. Research, Proc. Intern. Conf., Paris, 1957 4, 607-32 (Pub. 1958). CA 53-20957d

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USE OF C-14 IN STUDIES OF PLANT METABOLISM. G. Jolchine and A. Moyse. Ann. Nutr. (Paris) 17, B 79-B 105(1963)

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THE EFFECT OF THE ADDITION OF SUPPLEMENT UPON THE DEGRADATION OF MATERIALS OF THE CELLS OF CHLORELLA. Otto Kandler. (Univ. Munich, Ger.). Planta 51, 173-85(1958). CA-52: 11169f.

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IDENTIFICATION OF RADIOACTIVE HAMAMELONIC ACID FROM CHLORELLA FOLLOWING A SHORT PHOTOSYNTHETIC PERIOD IN C¹⁴O₂ AND HIGH POTASSIUM CYANIDE CONCENTRATION. Otto Kandler. (Univ. Munich, Ger.). Naturwissenschaften 44, 562-3(1957). CA-53: 1472b.

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INFLUENCE OF PHOTOSYNTHESIS OF INTRAMOLECULAR EXCHANGE PROCESSES OF HEXOSE. Otto Kandler and Martin Gibbs (Brookhaven Natl. Lab., Upton, N.Y.). Z. Naturforsch. 14b, 8-13(1959)(in German). CA 53-20282c

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OCCURRENCE OF AN UNKNOWN RADIOACTIVE SUBSTANCE AFTER SHORT-TIME PHOTOSYNTHESIS IN C¹⁴-CARBON DIOXIDE. O. Kandler. (Univ. of California, Berkeley). Arch. Biochem. Biophys. 73, 38-42(1958). CA-52: 8300d.

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ORNITHINE, CITRULINE, AND ARGININE METABOLISM IN WATERMELON SEEDLINGS. R. Kasting and C. C. Delwiche. (Univ. of California, Berkeley). Plant Physiol. 32, 350-4(1958). CA-53:3400a.

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RELATION BETWEEN INTENSITY OF PHOTOSYNTHESIS AND ENERGY OF RENEWAL OF CHLOROPHYLL. V. O. Kazaryan, G. G. Gabrielyan, and V. Sh. Agababyan. Doklady Akad. Nauk Armyan. S.S.R. 24, No. 5, 225-30(1957)(In Russian). CA-52-4755a.

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A MECHANISM FOR CYCLIC ENRICHMENT OF CARBON-12 BY TERRESTRIAL PLANTS. Charles D. Keeling (California Inst. of Tech., Pasadena). Geochim. et Cosmochim. Acta, 24: 299-313(July 1961). (In English)

A model is described which predicts that variations in the relative abundance of C¹² and C¹³ in terrestrial plants may be due in part to varying degrees of local cycling of

carbon dioxide gas. The model emphasizes the effectiveness of transient departures from a steady state in achieving cyclic enrichment, and predicts that cyclic enrichment should be limited by the maximum concentration of carbon dioxide occurring near the plants during their diurnal cycle. Experimental data are discussed which support the model.

762

RADIOCARBON IN CONTEMPORANEOUS PLANT PRODUCTS. V. N. Kerr, F. N. Hayes, E. Hansbury, and D. L. Williams. (Los Alamos Scientific Lab., N. Mex.) Oct. 27, 1961. (LAMS-2627(p.238-59))

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RADIOCARBON IN PLANT PRODUCTS: GEOGRAPHY, SPECIES, AND TIME. V. N. Kerr, D. L. Williams, E. Hansbury, and F. N. Hayes (Los Alamos Scientific Lab., N. Mex.). Z. Physik, 167: 273-83(1962). (In English)

C¹⁴ measurements, on a global scale, were made on a large number of essential oils obtained from various plants. The measurements allow conclusions to be drawn on the mixing of some compartments of the atmosphere and, in addition, metabolic differences between various species of plants are demonstrated. The course of C¹⁴ fall-out, as recorded by the various plants, is charted.

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ABSORPTION OF PHOSPHORUS-32 BY PLANTS UNDER DIFFERENT CONDITIONS OF TEMPERATURE AND ILLUMINATION. M. S. Khalil and H. Waldner. Acta Biol. Med. Germ. 5, 346-54(1960)

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TRITIUM AND CARBON-14 IN THE TREE RINGS. Kunihiko Kigoshi and Yoshio Tomikura (Gakushuin Univ., Tokyo). Bull. Chem. Soc. Japan, 34: 1738-9(Nov. 1961). (In English)

Measurements were made of the concentration of C¹⁴ and tritium in the tree rings of recent years in order to obtain the annual mean concentration of the atmospheric C¹⁴ and of the tritium in the rain water. The data on C¹⁴ showed a tendency of the concentration to decrease after 1960, and it seemed to have a maximum value at the beginning of 1960. The same was true for tritium concentrations. The data suggested a stratospheric residence time of 1 to 2 years.

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VARIATION OF RADIOCARBON CONCENTRATION IN MODERN WOOD. Kunihiko Kigoshi and Yoshio Tomikura (Gakushuin Univ., Tokyo). Bull. Chem. Soc. Japan, 33: 1576-80(Nov. 1960). (In English)

Results determined by using the carbon in tree rings of Japanese cedar trees are presented on the measurements of the atmospheric C¹⁴ increase in recent years. One tree was 177 years old, and the rings investigated covered the time span of 1782 to 1959. The analysis was carried out by counting acetylene formed from the wood carbon. It was found that (1) the C¹⁴ content is constant $\pm 2\%$ from 1782 to 1950, (2) a remarkable C¹⁴ increase occurred in the 1953 to 1959 range, (3) the samples from Tokyo, Akaita, and Mie show almost the same extent of increase after 1953, and (4) the C¹⁴ variations in the southern hemisphere follow those of the northern hemisphere, with a time lag of several months.

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STUDIES ON THE DISTRIBUTION OF P-32 IN RADISH. H. S. Kim (Dong Kook Univ., Korea). J. Nucl. Sci., 2: 119-21(1962). (In Korean)

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- Distribution of P^{32} in a pot-grown plant of the radish was studied by means of fertilization with phosphate labeled with P^{32} followed by autoradiography of the dried parts. An accumulation of P^{32} occurred in the growth point, root of hair, younger leaves, and top of leaves in the radish similarly to other plants. The activity was too low to monitor in the yellow leaves of the radish. P^{32} absorbed by the root in the radish was transported through the xylem of the radish tissue.
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A-MECHANISM OF CONVERSION OF FAT TO CARBOHYDRATE IN CASTOR BEANS. H. L. Kornberg and H. Beevers. (Univ. Oxford, Engl.). Nature **180**, 35-6(1957). CA-52: 13011i.
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BEHAVIOR OF LABELED CONIFERIN IN WOODY PLANTS. I. K. Kratzl, G. Billek, E. Klein, and K. Buchtela. (Univ. Vienna). Monatsh **88**, 721-34(1957). CA-52: 7448g.
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BEHAVIOR OF LABELED CONIFERIN IN THE LIGNIFYING PLANT. II. THE VANILLIN ACETALDEHYDE CLEAVAGE OF THE LIGNOSULFONIC ACIDS. K. Kratzl and G. Hofbauer. (Univ. Vienna). Monatsh **89**, 96-101(1958). CA-52: 14765g.
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RELATIVE BIOLOGICAL EFFECTIVENESS OF BETA-RAYS EMITTED FROM PHOSPHORUS-32. II. COMPARATIVE STUDIES ON EFFECTS OF X-RAYS AND PHOSPHORUS-32 BETA RAYS ON THE GROWTH PEA ROOTS AND ON CELL DIVISION IN VICIA FABA ROOTS. T. Kudnicki. Acta Physiol. Pol. **12**, 159-71(1961) Jan-Feb.
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DARK FIXATION OF CARBON DIOXIDE BY TOBACCO LEAVES. Geo. M. Kunitake, Clyde Stitt, and Paul Saltman (Univ. of S. California, Los Angeles). Plant Physiol. **34**, 123-7(1959). CA 53-11544e
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ORGANIC ACID METABOLISM IN ROOTS OF CUCURBITA PEPO. A. L. Kursanov and O. N. Kulaeva. Fiziol. Rastemoo. Akad. Nauk S.S.S.R. **4**, 322-31(1957). CA-52-13741.
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BIOLOGICAL EFFECTIVENESS OF C¹⁴ WHEN INCORPORATED IN LIVING STRUCTURES. A. M. Kuzin, B. M. Isaev, V. V. Khvostova, V. I. Tokarskaya, and Yu. I. Bregadze (Inst. of Biological Physics, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R. **134**, 951-4 (1960) Oct. 1. (In Russian)
Biological effects of C¹⁴ incorporated into the cell structure were quantitatively correlated to the effects of Co⁶⁰ γ radiation in 10-day vicia faba plants. The percentage of cells with chromosome aberrations was used as the criterion of biological effects. The data show 9 to 25 fold stronger mutation effects from C¹⁴ at identical absorbed energies. It is postulated that a considerable fraction of the mutations results from transformation effects, i.e., by C¹⁴ → N¹⁴ and by the special geometry of radioactive carbon incorporation.
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(AEC-tr-4531) EFFECTIVENESS OF THE BIOLOGICAL ACTION OF C¹⁴ WHEN INCLUDED IN LIVING STRUCTURES. A. M. Kuzin, B. M. Isaev (Isayev), V. V. Khvostova, V. I. Tokarskaya, and Yu. I. Bregadze (Akademiya Nauk S.S.S.R.). 1960. Translation of United Nations Report A/AC.82/G/L.423. 9p.
The biological effects of a two or three day exposure to beta particles from C¹⁴ were compared with the effects of a similar radiation dose from external Co⁶⁰ gamma radiation. The percentage of cells of Vicia faba with chromosome aberrations at the growth points of the stem following exposure was used as a criterion for biological action. Data are tabulated. Analysis of results shows that the mutagenic effect of C¹⁴ introduced into the cells is 9 to 15 times greater than the effect of equal absorbed doses of outside gamma radiation. It is assumed that a significant part of the mutagenic effect of C¹⁴ depends on the conversion of C¹⁴ to N¹⁴. The possible influence of radioactive carbon from the explosion of megaton hydrogen bombs on living organisms is discussed briefly.
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NATURE OF SUBSTANCES BINDING CARBON DIOXIDE IN PHOTOSYNTHESIS. A. M. Kuzin and G. N. Saenko. (Inst. Biol. Phys., Moscow). Biofizika **2**, 313-16(1957). CA-52-2190e.

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DISTRIBUTION STUDIES OF RADIOACTIVE FLUORINE-18 AND STABLE FLUORINE-19 IN TOMATO PLANTS. Myron C. Ledbetter, Radu Mavrodineanu, and Allen J. Weiss (Brookhaven National Lab.). Contribs. Boyce Thompson Inst. 20, 331-48(1960) Jan.-Mar. (BNL-4721)

A study of distribution and site of accumulation of fluorine in tomato plants was carried out using NaF^{18} , HF^{18} , NaF^{19} , and HF^{19} applied as solutions through roots and cut vascular systems, and in gaseous form to the aerial parts. In order of decreasing concentration, the gross distribution of fluorine applied as NaF^{19} through the soil was: roots, lower leaves, upper leaves, and stems. Regardless of the path of entrance of the fluorine into the plant, it was possible to wash up to 68 per cent of the fluorine from the leaves with distilled water and up to 83 per cent with water containing a detergent (Tween #20). Distribution based on autoradiograms showed that most accumulation of F^{18} applied as HF^{18} to tomato plants was at the tips and margins of leaflets and in the glands along the stem. Little F^{18} was found in the stems and petioles. In short-term or long-term experiments up to 80 per cent of the F^{18} or F^{19} of the leaves applied as HF was found in the stripped epidermis of Sedum spectabile Boreau. Distribution of F^{18} applied as HF^{18} to tomato leaves after long-term accumulation was, in order of decreasing concentration: cell walls, chloroplasts, soluble proteins, mitochondria, and microsomes. With short-term accumulation of F^{18} applied as HF^{18} the order was: soluble proteins, chloroplasts, cell walls, and mitochondria. The fluorine in the chloroplasts was associated mainly with the proteinaceous substances since little or no F^{18} was found in the pigments and lipids.

785

UPTAKE OF STRONTIUM-85 BY ALFALFA. C. C. Lee (Univ. of Saskatchewan, Saskatoon, Can.). Science, 138: 41-2(Oct. 1962).

Experiments with alfalfa were carried out to study the possibility of changes with time in the availability of radio-strontium in soil. After the soil was treated once with Sr^{85} , the first crop was harvested after 60 days of growth. Four subsequent crops, cut at successive 4-week intervals, were examined. The difference in uptake between the second and fifth crops was statistically significant, suggesting that some fixation of Sr^{85} may occur in the soil. The effects of various applications of ammonium dihydrogen phosphate, monocalcium phosphate, calcium chloride, and potassium chloride on the uptake of Sr^{85} by alfalfa were also investigated. Of the experiments carried out, only the treatment with 1.0 meq of potassium per 100 g of soil resulted in a statistically significant reduction in strontium uptake.

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SELECTIVE INHIBITION OF PHOTOSYNTHESIS BY METHANOL IN SCENEDESMUS. Marcel Lefrançois and Cyrias Ouellet. (Laval Univ., Quebec). Can. J. Botany 36, 457-66(1958). (In French). CA-53:2381g.

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METABOLISM OF LABELED ACETATE IN BRYOPHYLLUM CALYCINUM. Herbert Lieberman, John E. Christian, and Egil Ramstad. (Purdue Univ., Lafayette, Indiana). J. Am. Pharm. Assoc. 47, 493-6(1958). CA-52: 16502e.

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OBSERVATIONS ON THE BEHAVIOUR OF PHOSPHATE COMPOUNDS IN CHLORELLA AT THE TRANSITION FROM DARK TO LIGHT. W. Lindeman (Agricultural Univ., Wageningen, The Netherlands). 17p.

Trichloroacetic acid extracts of *Chlorella* cells, which had been labeled with P^{32} for 24 hours, were analyzed by paper chromatography. The decrease in orthophosphate and the increase in nucleotides, observed at the transition from dark to light, were considered as indications of light phosphorylation. A rapid decrease in phosphoglyceric acid, interpreted as the reduction of this compound, occurred simultaneously. Since this reduction probably consumed energy-rich phosphate bonds, releasing free orthophosphate, this consumption was considered in estimating the rate of light phosphorylation and the P/O ratio.

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UNKNOWN METABOLIC INTERMEDIATES IN PLANTS. Pekka Linko. (Biochem. Inst., Helsinki). Acta Chem. Scand. 12, 129-31(1958)(in English). CA-53:4431e.

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CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. II. LABELING PATTERNS IN THE FREE SUGARS. Frank A. Loewus, Rosie Jang, Walter Mann, Jr., and Arthur Bevenus. (Western Regional Research Lab., Albany, Calif.). J. Biol. Chem. 232, 505-19(1958). CA-52: 16503f.

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CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. III. LABELING PATTERNS FROM BERRIES ADMINISTERED PENTOSE-1- C^{14} . Frank A. Loewus, Rosie Jang, Walter Mann, Jr., and Arthur Bevenus. (Western Research Lab., Albany, Calif.). J. Biol. Chem. 232, 521-32(1958). CA-52: 16503i.

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CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. IV. A COMPARATIVE STUDY OF D-GALACTURONIC ACID AND L-ASCORBIC ACID FORMATION. Frank

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THE ABSORPTION AND UTILIZATION OF PHOSPHATE BY YOUNG BARLEY PLANTS. IV. THE INITIAL STAGES OF PHOSPHATE METABOLISM IN ROOTS. B. C. Loughman and R. Scott Russell. *J. Exptl. Botany* **8**, 280-93 (1957). CA-52-2180c.

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METHODS AND EQUIPMENT FOR THE STUDY OF THE INCORPORATION OF PHOSPHORUS BY INTACT BARLEY PLANTS IN EXPERIMENTS OF SHORT DURATION. B. C. Loughman and R. P. Martin. (Univ. Oxford, Engl.). *J. Exptl. Botany* **8**, 272-9 (1957). CA-52-2180a.

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CHANGES IN THE DISTRIBUTION OF GLUCOSE 14C IN ALTERNATIVE CATABOLIC PATHWAYS INDUCED BY KINETIN-ANALOGUE IN THE CALLUS TISSUE OF CARROT (DAUCUS CAROTA L.). J. Lustinec, E. Petru, and V. Pokorna. *Experientia* **18**, 187 (1962)

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ANAEROBIC SYNTHESIS OF STARCH FROM GLUCOSE IN TOBACCO LEAF DISKS. G. A. MacLachlan and H. K. Porter. (Imp. Coll. Sci. and Technol., London). *Biochem. J.* **70**, 11P (1958). CA-53:3381g.

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NITROGEN-15 AS A TRACER OF NITROGEN METABOLISM OF PLANTS. Robert MacVicar (Oklahoma A. and M. Coll., Stillwater). *Publ. Am. Assoc. Advance Sci.* No. 49, 111-22 (1957). CA 53-18188f

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RADIATION EFFECTS ON THE GROWTH AND PHOSPHORUS UPTAKE OF PLANTS GROWN IN SOIL TREATED WITH P³². P. G. Marais and S. Fourie (Western Province Fruit Research Station, Stellenbosch, Union of S. Africa). *S. African J. Agr. Sci.* **2**, 3-18 (1959) Mar. (In English)

The effect of radiation from P³² on the growth and phosphorus uptake of rye and tomato plants was studied in soil culture. The plants were grown for 4, 7, and 12 weeks in two soils which were enriched with phosphate and treated with 0, 4, or 40 microcuries P³² per pot. The plant tops and roots were analyzed separately. The radiation effects observed were mainly stimulative, but did not vary directly with increasing levels of P³². They depended on the species of plant employed, its age, and the soil in which it was grown. Furthermore, the P³² had a differential effect on the tops and roots, and on the dry weights and phosphorus contents of the plants. The magnitude of these effects was such that the influence of radiation cannot

simply be ignored. It is concluded that in investigations of this type, experimental results must be accepted with reserve unless positive proof is afforded that radiation has had no significant effect.

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RADIOACTIVITY OF SOILS, PLANT ASHES AND ANIMAL BONES. Ernest Marsden (Royal Cancer Hospital, London). *Nature* **183**, 924-5 (1959) Apr. 4.

Alpha-activity measurements were made of bones of a New Zealand cow and ewe and their offspring. Also some observations on the influence of superphosphate on plant and animal uptake of radioactivity are made.

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SPECIFICITY OF CHLORIDE DEFICIENCY IN LEMNA MINOR. Georges Martin and Jean Lavollay. *Compt. rend. soc. biol.* **152**, 241-4 (1958). CA-53:3383f.

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UPTAKE AND TRANSLOCATION OF 3-AMINO- AND 3-HYDROXY-1,2,4-TRIAZOLE IN PLANTS. P. Massini. (Philips Research Lab., Eindhoven, Neth.). *Acta Botan. Neerl.* **7**, 524-30 (1958). CA-53:3385a.

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RADIATION GENETICS IN WHEAT. VII. COMPARISON OF RADIATION EFFECTS OF BETA- AND GAMMA-RAYS ON DIPLOID WHEAT. S. Matsumura (National Inst. of Genetics, Misima, Japan). *Radiation Botany*, **1**: 155-64 (Jan. 1962). (In English)

Seeds of *Triticum monococcum flavescens* were soaked in P³² and I¹³¹ solutions for 2 days before sowing, to compare the effects of beta and gamma radiations. Radioactive solutions of pH 6-7 contained 0.05-0.8 mc/gr P³² and 0.2-0.8 mc/g I¹³¹. For comparison, seeds soaked in water for 2 days were exposed to gamma radiation with Co⁶⁰ at the dosages 2.5, 5, 10, and 20 kr. The growth of seedlings, height of mature plants, single-spike fertility, and chromosome aberrations of treated plants in X₁ and chlorophyll mutations in X₂ were compared for beta and gamma irradiation. The higher the dosage of beta and gamma rays, the more delayed were emergence and growth of seedlings and the lower were survival rate, height of mature plants, and fertility. The relation between the inhibition of seedling growth and dosage of beta and gamma radiations coincides roughly with that between the decrease of survival rate or fertility and dosage. There was no emergence of seedlings at 20 kr gamma radiation and 0.8 mc/g P³² beta radiation. The effects of beta radiation from 0.15-0.2 mc/g P³² and 0.8 mc/g I¹³¹ solutions correspond roughly to those of 2.5 kr gamma radiation. As to chromosome aberrations and chlorophyll mutations, the effects of 2.5 kr gamma radiation coincide roughly with those of 0.1 mc/g P³² and 0.6-0.8 mc/g I¹³¹ solution. If it is assumed that the effects of beta radiation are confined only to the embryo, then a 0.2 mc/g P³² solution equals about 2.4 krad. This will account for the present data.

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CARBON DIOXIDE FIXATION INTO OXALACETATE IN HIGHER PLANTS. Mendel Mazelis and Birgit Vennesland. (Univ. of Chicago). *Plant Physiol.* **32**, 591-600 (1958). CA-52: 7453i.

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RADIOCARBON STUDIES ON THE TRANSLOCATION OF ORGANIC CONSTITUENTS INTO RIPENING

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TOMATO FRUITS. John P. McCollum (Univ. of Illinois, Urbana) and John Skok. *Proc. Am. Soc. Hort. Sci.* **75**, 611-16(1960).

P^{32} -labeled phosphate applied to leaves or peduncles of tomato plants moved readily into fruits of all maturity stages, regardless of the relative position of leaf and fruit cluster. The movement of C^{14} -glucose applied to leaves, is governed largely by the vascular anatomy intervening between the site of application and the fruit. If the selected leaf is in the same vertical sector as the fruit, translocation paths for sugar are generally adequate. Under these circumstances, sugar applied to a leaf moved into green fruits and fruits at the turning stage, but not into ripe fruits. In the case of ripe fruit, sugar moved into the peduncle, past the mid-separation zone of the pedicel and up to the calyx, but not past the abscission layer between the calyx end of the pedicel and the fruit. The movement of labeled organic materials into fruits of various stages of maturity may best be determined by labeling the entire photosynthetic supply with $C^{14}O_2$. The products of photosynthesis moved most rapidly into the youngest green fruits that were developing rapidly and increasing in size. The rate of movement decreased as the green fruit developed further and reached a low point at the mature green stage when the fruit had attained full size. Activity again increased at the turning stage, indicating a rise in the movement of organic constituents into fruits at incipient coloration. Activity dropped as pigment formation and ripening progressed and became negligible when the fruit had attained the ripe stage. These results indicate that maximum quality of ripe tomatoes would not be impaired if they were harvested just prior to the full-ripe stage on the basis that most of the organic constituents supplied by the leaves had by this time entered the fruits. Such a procedure would take advantage of the reduction in high field losses which are sustained when harvesting is carried out at the full-ripe stage. The results further indicate that the quality of immaturely harvested fruits could be measurably improved if they were harvested when coloration began to appear rather than at the mature green stage as is normally practiced commercially in the green wrap industry. Most of the organic constituents have entered the fruit by about five days or so past the turning stage.

808

STUDIES ON WHEAT PLANTS USING CARBON-14 COMPOUNDS. V. GERMINATION STUDIES WITH LABELED WHEAT SEEDS. W. B. McConnell. (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **35**, 1259-66 (1957). CA-52-4758h.

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STUDIES ON WHEAT PLANTS USING CARBON-14 COMPOUNDS. IX. RADIOACTIVITY OF WHEAT FOLLOWING INJECTION OF FORMATE- C^{14} AND GLYCINE-1- C^{14} WITH SPECIAL REFERENCE TO SERINE LABELING. W. B. McConnell and E. Bilinski (Prairie Regional Lab., Saskatoon, Saskatchewan). *Can. J. Biochem. and Physiol.* **37**, 549-55 (1959). CA 53-9392f

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STUDIES ON WHEAT PLANTS USING CARBON-14 LABELED COMPOUNDS. X. THE INCORPORATION OF GLUTAMIC ACID-1- C^{14} . W. B. McConnell (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **37**, 933-6(1959). CA 53-18202g

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FEATURES OF PHOSPHORUS METABOLISM IN NUCLEIC ACIDS FORMED DURING VARIOUS PERIODS OF PLANT DEVELOPMENT. Zh. A. Medvedev (K. A. Timiryazev Agr. Acad., Moscow). U.S. At. Energy Comm. AEC-tr-3376, 87-98(1957). CA 53-9375c

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TRANSLOCATION OF CATIONS TO SEEDLINGS OF PINUS VIRGINIANA THROUGH MYCORRHIZAL MYCELIUM. Elisa Melin, Harald Nilsson, and Edward Hacskeylo. (Univ. Uppsala, Swed.). *Botan. Gaz.* **119**, 243-6(1958). CA-52: 20454h.

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FOLIAR RETENTION OF STRONTIUM-90 BY WHEAT. Ronald G. Menzel, Donald L. Myhre, and Howard Roberts, Jr. (U. S. Agricultural Research Service, Beltsville, Md.). *Science*, **134**: 559-60(Aug. 25, 1961).

Wheat harvested from the University of Maryland Agronomy Farm in June 1959 contained 20 to 50 micro-microcuries of strontium-90 per kilogram of grain. More than 90% of the strontium-90 came from deposition on aboveground plant parts, and less than 10% was taken up through the soil. About 1 to 2% of the strontium-90 fallout during the time the heads were exposed was retained in the grain.

814

AECU-4119

Department of Agriculture. Agricultural Research Service, Beltsville, Md.

POLONIUM UPTAKE BY PLANTS. R. G. Menzel. [1953?] 4p. \$1.80(ph), \$1.80(mf) OTS.

Data are tabulated on the uptake of polonium by plants. The distribution of polonium was measured in red clover, Sudan grass, and astragalus following uptake of polonium-210 from solutions.

815

M-7126

Bureau of Plant Industry, Soils, and Agricultural Engineering. Div. of Soil and Plant Relationships, Beltsville, Md.

RUTHENIUM(III) AND IRON UPTAKE BY RED CLOVER FROM NUTRIENT SOLUTION. R. G. Menzel and I. C. Brown. [195?]. 4p. \$1.80(ph), \$1.80(mf) OTS.

Data are presented on the distribution of ruthenium-103-106 and iron in various parts of red clover plants grown in nutrient solutions with various ratios of ruthenium to iron.

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EVIDENCE FOR AN UNSTABLE CARBON DIOXIDE FIXATION PRODUCT IN ALGAL CELLS. Helmut Metzner, Helmut Simon, Barbara Metzner, and Melvin Calvin. (Univ. of California, Berkeley). *Proc. Natl. Acad. Sci. U.S.* **43**, 892-5(1957). CA-52-3035f.

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LABILE PRODUCTS OF EARLY CARBON DIOXIDE FIXATION IN PHOTOSYNTHESIS. Helmut Metzner, Barbara Metzner, and Melvin Calvin. (Univ. of California, Berkeley). *Arch. Biochem. Biophys.* **74**, 1-6(1958). CA-52: 9330g.

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RELATIVE UPTAKE AND TRANSLOCATION OF POTASSIUM AND CESIUM IN BARLEY. Lawrence J. Middleton, Raymond Handley, and Roy Overstreet (Univ. of

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The relative rates of uptake of potassium and cesium by excised roots and by intact plants of barley from solutions have been measured by K^{42} and Cs^{137} . The results have been expressed as the observed ratio (O.R.): O.R. = $(Cs^{137}/K^{42} \text{ plant}) / (Cs^{137}/K^{42} \text{ solution})$. In excised roots, in external concentrations of potassium up to 1.0 meq/l, the O.R. was in the range of 0.15 to 0.25. At a higher concentration (10 meq/l), the O.R. was approximately 0.4, thus indicating a lower selectivity for potassium at this level. In the transfer from root to shoot, a marked effect of potassium concentration on the O.R. was observed. At a concentration of 0.1 meq/l, K^{42} was transferred at 10 to 20 times the rate of Cs^{137} (mean O.R. = 0.06). At 10 meq/l, K^{42} was transferred at only twice the rate of Cs^{137} (O.R. = 0.5). When the proportions of added stable potassium and cesium in the medium were varied over a very wide range, the O.R. was affected by a factor of less than two. When the rate of potassium uptake was low or when water movement was restricted, the O.R. in the shoots was greater than unity, showing a greater transference of Cs^{137} .

819

UPTAKE OF AMINO ACIDS BY THE PEA PLANT (*PISUM SATIVUM*)--MECHANISM STUDIED USING C^{14} -LABELED ALANINE AND GLUTAMIC ACID. Jorma K. Miettinen (Biochem. Inst., Helsinki). Suomen Kemistilehti **30B**, 30(1957) (in English). CA 53-16295b

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DYNAMIC STUDIES ON NUTRIENT UPTAKE BY CROP PLANTS. XIV. INTAKE AND TRANSFORMATION P^{32} -PHOSPHORIC ACID IN THE ROOT OF WHEAT SEEDLINGS. Shingo Mitsui, Sueo Aso, and Kozo Ishizuka. (Univ. Tokyo). Soil and Plant Food (Tokyo) **3**, 65-9(1957). CA-52: 8302a.

821

DYNAMIC STUDIES ON NUTRIENT UPTAKE BY CROP PLANTS. XIV. INTAKE AND TRANSFORMATION OF PHOSPHORUS-32 LABELED PHOSPHORIC ACID IN ROOT OF WHEAT SEEDLINGS. Shingo Mitsui, Sueo Aso, and Kozo Ishizuka (Univ. Tokyo). Nippon Dojo Hiriyogaku Zasshi **28**, 262-4(1957). CA 53-8318c

822

THE UPTAKE AND UTILIZATION OF CARBON BY PLANTS FROM CARBON-14 LABELED UREA. I. THE DETERMINATION OF RADIOACTIVE CARBON OF PLANT MATERIALS AND A PRELIMINARY SEEDLING EXPERIMENT UTILIZING CARBON-14-LABELED UREA. Shingo Mitsui and Kiyoshi Kurihara (Univ. Tokyo). Nippon Dojo Hiriyogaku Zasshi **28**, 439-43(1958). CA 53-19048i

823 A/CONF.15/P/1353

THE UTILIZATION OF Ca BY CROP PLANTS FROM Ca-45 LABELED TIME NITROGEN. Shingo Mitsui and Kiyoshi Kurihara (Tokyo Univ.), and Susumu Sonoda, Shoichi Sawayanagi, Teizo Morishita, Toru Hirayama, Kazuyoshi Hamada, and Akira Terakawa (Showa Denko Kabushiki Kaisha, Tokyo). 17p.

Lime nitrogen labeled with calcium-45 was used in a study of the utilization of calcium in lime nitrogen by wheat. Results indicate that calcium in lime nitrogen can serve as a good source of nutrient calcium as well as an acid neutralizing agent.

824

ARGININE METABOLISM IN PLANT TISSUES. Georges Morel and Henri Duranton. Bull. soc. chim. biol. **40**, 2155-67(1958). CA 53-11535c

825

THE PATH OF CARBON IN PHOTOSYNTHESIS. XXIII. THE TENTATIVE IDENTIFICATION OF ERYTHROSE PHOSPHATE. V. Moses and M. Calvin (Univ. of California, Berkeley). Arch. Biochem. Biophys. **78**, 598-600(1958) Dec.

Tentative evidence is presented of the occurrence of erythrose 4-phosphate in *Chlorella* allowed to carry on photosynthesis in the presence of $C^{14}O_2$.

826

PATH OF HYDROGEN IN PHOTOSYNTHESIS. V. Moses and M. Calvin. (Univ. of California, Berkeley). Biochem. J. **71**, 16P(1959). CA-53:5415b.

827

PHOTOSYNTHESIS STUDIES WITH TRITIATED WATER. V. Moses and M. Calvin (Univ. of California, Berkeley). Biochim. et Biophys. Acta **33**, 297-312(1959).

A study has been made of the incorporation patterns of tritium from tritium oxide by *Chlorella* cells under conditions of light and dark. A new apparatus has been designed for use in photosynthesis experiments which necessitate the employment of dense cell suspensions and substrates of high specific activity. The incorporation patterns of $C^{14}O_2$ in the presence and absence of tritiated water showed little evidence of physiological damage due to radiation. The substances incorporating tritium were essentially the same as those incorporating C^{14} from $C^{14}O_2$. However, the percentage distribution of the tracer among the labelled compounds showed considerable differences from the carbon pattern. At the shortest incubation periods in the light, tritium appeared mainly in the sugar monophosphates, phosphoglyceric acid, aspartic acid, glutamic acid, and malic acid. These substances also incorporated label most rapidly in the dark, though in this case a greater percentage of the activity fixed appeared in the amino acids. About three times as much tracer was fixed in the light as in the dark. The total activity fixed, and its distribution, was affected to some extent by the presence of ammonium or nitrate ions in the medium. Glycolic acid was labelled very early, and was the most active compound present. A scheme for hydrogen transport in photosynthesis involving an alternate oxidation and reduction of glycolic and glyoxylic acids is proposed. The difficulties of interpreting the results of biochemical studies with hydrogen isotopes due to non-specific exchange reactions are discussed.

828

RESPONSE OF CHLORELLA TO A DEUTERIUM ENVIRONMENT. V. Moses, O. Holm-Hansen, and M. Calvin. (Univ. of California, Berkeley). Biochim. et Biophys. Acta **28**, 62-70(1958). (in English). CA-52: 12103e.

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ACTION OF LIGHT UPON β -CARBOXYLATION AND OXIDATION IN THE LEAVES OF BRYOPHYLLUM. A. Moyse and G. Jolchine. Bull. soc. chim. biol. **39**, 725-45(1957). CA-52: 9319e.

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EFFECTS OF INDOLEACETIC ACID ON THE UTILIZATION OF ACETATE- 1-C^{14} BY PEA STEM SLICES. James F. Nance. (Univ. of Illinois, Urbana). *Plant Physiol.* **33**, 93-8(1958). CA-52: 10301b.
- 831**
AN ABNORMAL NUCLEOLAR CONDITION INDUCED IN CORN BY RADIOACTIVE PHOSPHORUS TREATMENT. A. T. Natarajan and M. S. Swaminathan (Indian Agr. Research Inst., New Delhi). *Naturwissenschaften* **45**, 494-5(1958) (in English). CA 53-10397i
- 832**
THE BIOSYNTHESIS OF CELL-WALL CARBOHYDRATES. IV. FURTHER STUDIES ON CELLULOSE AND XYLAN IN WHEAT. A. C. Neish. (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **36**, 187-93(1958). CA-52: 7449i.
- 833**
NOTE ON A RAPID TRANSLOCATION OF PHOTO-SYNTHETICALLY ASSIMILATED CARBON- 14 OUT OF THE PRIMARY LEAF OF THE YOUNG SOYBEAN PLANT. C. D. Nelson, Harold J. Perkins, and Paul R. Gorham. (National Research Council, Ottawa, Can.). *Can. J. Biochem. and Physiol.* **36**, 1277-9(1958). CA-53:3398c.
- 834** (UCLA-468) A COMPARISON OF UPTAKE OF STRONTIUM 90 AND CESIUM 137 BY BRYOPHYTES AND VASCULAR PLANTS. H. Nishita, D. Dixon, and K. H. Larson (California Univ., Los Angeles. School of Medicine). Dec. 19, 1960. Contract AT(04-1)-GEN-12. 7p.
An experiment was conducted to compare the uptake of Sr^{90} and Cs^{137} by bryophytes and higher sporophytic plants grown on contaminated soil.
- 835** INCORPORATION OF Sr^{90} - Y^{90} IN PLANTS: RADIOAUTOGRAPHIC STUDY OF INCORPORATION IN VICIA FABA. Constantino Nuñez. Rev. pubs. navales, **14**: 1-17(Jan.-Feb. 1961). (In Spanish)
Studies performed in *Vicia faba* using radioautographic techniques orientated to demonstrate the Sr^{90} metabolism showed the active circulation of the radioelement in the conduction (vascular) system of the plant which contrasts with a low cell incorporation of Sr^{90} showed by autoradiographs. In radioautographs of high resolution, meristematic cells showed a low protoplasmatic incorporation around the nucleus, with an aspect of perinuclear crown. Radioautographs of stem and leaves showed a progressive and strong decrease of circulation through feeble or negative macroradiographs and negative autoradiographs. These findings suggest that the radioelement circulates actively through the plant without metabolization in parenchymatic tissues or, at least, in a very feeble condition in cellular groups with a very high metabolic activity (meristematic cells of the root), and that Sr^{90} distribution is highly reduced in stem and leaves. This behavior would confirm the importance of direct deposition mechanism of Sr^{90} from fall-out on the surface of leaves in the first step of food chains.
- 836**
ACTIVATION OF BASAL PROCESSES (METABOLIC AND ENZYMIC) IN BARLEY BY ULTRASONICS. Georges Obolensky. (Univ. Paris). *Materiae Vegetabiles (The Hague)* **2**, 298-335(1957). (in French). CA-52: 13020h.
- 837**
IMPORTANCE OF BIOPOTENTIALS TO ENTRANCE AND MOVEMENT OF SUBSTANCES IN PLANTS. V. A. Opritov. (N. I. Lobachevskii State Univ., Gorki). *Biofizika* **3**, 38-44(1958). CA-52: 12107d.
- 838**
EFFECT OF WATER STRESS ON THE CELL-WALL METABOLISM OF PLANT TISSUE. L. Ordin (Agr. Research Sta., Rehovot, Israel). *Radioisotopes Sci. Research, Proc. Intern. Conf., Paris, 1957*, **4**, 553-64(Pub. 1958). CA 53-20311i
- 839**
INFLUENCE OF NITROGEN FERTILIZATION AND CLIPPING ON GRASS ROOTS. D. L. Oswalt, A. R. Bertrand, and M. R. Teel (Purdue Univ., Lafayette, Indiana). *Soil Sci. Soc. Am., Proc.* **23**, 228-30(1959). CA 53-19260h
- 840** A/CONF.15/P/1494
AN APPROACH FOR USING LABELLED RADIOACTIVE PHOSPHORUS (P^{32}) IN PHYSIO-PATHOLOGICAL STUDIES OF PLANT-NEMATODE DISEASES. B. A. Otieta, Y. Barrada, and D. M. El Gindi (Cairo Univ., Giza, Egypt). 12p.
Results are reported from a study of the effect of the rootknot nematode, *Meloidogyne javanica*, on the nutritional status of one-month old tomato plants. The uptake of phosphorus-32 from nutrient solution by various parts of the plant was measured.
- 841**
RESULTS OF RADIOACTIVE POTASSIUM ON GROWTH OF PLANTS. E. I. Panteleeva. *Zapiski Leningrad. Sel'skokhoz. Inst.* **1956**, No. 11, 208-11. CA-52: 20426e.
- 842** CARBON ISOTOPE FRACTIONATION DURING PHOTOSYNTHESIS. R. Park and S. Epstein (California Inst. of Tech., Pasadena). *Geochim. et Cosmochim. Acta*, **21**: 110-26(1960). (In English)
A study was made of the reasons for isotopic fractionation in photosynthesis and the various factors controlling it. CO_2 samples from plants, air, and calcium carbonate were analyzed in a mass spectrometer in order to determine $\text{C}^{13}/\text{C}^{12}$ and $\text{O}^{18}/\text{O}^{16}$ ratios. The relative isotopic compositions of the samples and the fractionation factor between CO_2 and fixed plant carbon were determined. The effects of high light intensities on the fractionation factors of photosynthesis were studied. Results indicated that greater C^{12} enrichment occurred at high CO_2 concentrations and that light intensity was not important. Experiments on the extraction of "dissolved CO_2 " and on the enzymic fixation of carbon dioxide suggested that the major fractionation of carbon isotopes in the photosynthetic fixation of atmospheric CO_2 is due to two steps. The first step involves the preferential uptake of C^{12} from the atmosphere and the second step the preferential conversion of C^{12} -rich "dissolved CO_2 " to phosphoglyceric acid, the first product of photosynthesis. Subsequent metabolism of photosynthetic products was accompanied by isotope fractionation. However, these fractionations affected the

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isotopic composition of only a few minor constituents of the plant.

843 METABOLIC FRACTIONATION OF C^{13} & C^{12} IN PLANTS. Roderic Park and Samuel Epstein (California Inst. of Tech., Pasadena). *Plant Physiol.*, 36: 133-8 (Mar. 1961).

C^{13}/C^{12} ratio analyses of chemical fractions from several plant phyla show that in all cases the lipid fraction is enriched in C^{12} compared to the whole plant. The C^{13}/C^{12} ratio of the plant lipids corresponds roughly to the C^{13}/C^{12} ratio of petroleum. The C^{12} enrichment in petroleum as compared to present day plants can be explained if selective preservation of plant lipids occurred during the sedimentation process. The degree of C^{12} enrichment in the plant lipid fraction is inversely related to the amount of lipid in the plant. The C^{12} enrichment which occurs in plant lipids may be balanced by the C^{13} enrichment which occurs in respired CO_2 . Isotope selection at the level of acetate or pyruvate is a possible mechanism for explaining our results.

844 THE PROCESSES OF PHOTOSYNTHESIS IN THE LIGHT OF RECENT RESEARCH WITH $C-14$ RADIO-ACTIVE CARBON. M. Parovina. *Minerva Med.* 53, 1018-21 (1962) Apr.

845 ACCUMULATION OF CAESIUM-137 BY PLANTS GROWN IN SIMULATED POND, WET MEADOW AND IRRIGATED FIELD ENVIRONMENTS. R. C. Pendleton and R. L. Uhler (General Electric Co., Richland, Wash.). *Nature* 185, 707-8 (1960) Mar. 5.

The availability of cesium-137 to plants was examined under conditions simulating shallow ponds, wet meadows, and irrigated fields. The uptake ratio was found to be 450:30:1. Implications are discussed of the findings on plant uptake of and subsequent incorporation into the food chain of cesium-137 from fall-out.

846 A TISSUE-AUTORADIOGRAPHIC STUDY OF THE TRANSLOCATION OF CARBON-14-LABELED SUGARS IN THE STEMS OF YOUNG SOYBEAN PLANTS. Harold J. Perkins, C.D. Nelson, and Paul R. Gorham (Nat'l. Research Council, Ottawa). *Can. J. Botany* 37, 871-7 (1959) CA 53-22294h

847 TOPOCHEMICAL INVESTIGATIONS ON POST MEIOTIC POLLEN MITOSIS IN FRITILLARIA MELEAGRIS. Hans H. Pfeiffer. (Lab. Polar-Microscopy, Bremen, Ger.). *Ber. deut. botan. Ges.* 70, 217-20 (1957). CA-52: 10298g.

848 (TID-11156) PHYSIOLOGICAL CROP ECOLOGY USING RADIOISOTOPES. Annual Report for Year June 1, 1960 to February 28, 1961. (Minnesota. Univ., St. Paul. Inst. of Agriculture). Nov. 1960. 64p. Contract AT(11-1)-783.

Investigations were made on the circulation pattern for the translocation of P^{32} in soybean. Application of P^{32} to cotyledons, primary leaves, and the first trifoliate leaf was made at intervals of from 2 to 5 days during the lives of the organs. The subsequent movement of P^{32} was observed. Translocation of P^{32} in adult corn plants was studied in

order to find an efficient and safe method of applying P^{32} to corn. Two methods were tried, one using lanolin and one Van Tieghem cells. The latter was found to be the most effective. Studies were continued on the patterns of translocation in pea plants particularly in respect to flowering and fruiting. Studies confirmed earlier work showing that there is a strong direction of movement of material from the bloom node leaf to the fruit at that node. Distribution patterns for C^{14} supplied as $C^{14}O_2$ and for P^{32} were studied for pea. The rate of movement of P^{32} across the epidermis of oats, wheat, and onion was found to be from 50 to 150 cpm per second. Most uniform results were obtained with onion. The movement of P^{32} , Zn^{65} , S^{35} , and Sr^{89} in the mycelium of *Rhizoctonia solani* was observed. These studies demonstrate conclusively that soil fungi can translocate radioisotopes *in vitro*. This is part of a study to determine the effectiveness of soil fungi in translocating materials *in situ* in the soil. Studies were continued on the exchange of foliarly applied P^{32} between soybeans and its weed competitors. Additional equipment has been installed in the field laboratory at Rosemount. These include the thermocouple network and panel. The records are being taken on solar radiation, precipitation, and wind velocity and direction. The experimental plots involving a 5-crop rotation were established. Field plots for the placement of Sr^{90} were prepared in order to study the uptake and movement of Sr^{90} in soybeans and corn.

849 UPTAKE OF RADIOSTRONTIUM BY AN ALGA, AND THE INFLUENCE OF CALCIUM ION IN THE WATER. D. C. Pickering and J. W. Lucas (Coll. of Tech., Liverpool). *Nature*, 193: 1046-7 (Mar. 17, 1962).

The uptake of radiostrontium by the algae *Rhizoclonium hieroglyphicum* was studied with respect to the effects of Ca^{2+} ions in the water. Equilibrium between the algae and the water (pH 5.8) was found to be reached in ~10 days. The Sr and Ca results for the algae are presented as plots of the logarithm of the concentration factor of Sr or Ca in the algae vs the logarithm of the Ca^{2+} concentration in water ($\mu M/g$), and the curves are fitted by the equations $\log CF_{Sr} = 2.17 - 1.05 \log [Ca^{2+}]$ and $\log CF_{Ca} = 2.16 - 0.935 \log [Ca^{2+}]$. The calculated discrimination factor (Sr/Ca) shows that the algae discriminates in favor of Sr at low Ca^{2+} concentrations.

850 THE STABILITY OF ACCUMULATION COEFFICIENTS FOR Sr^{90} , Y^{91} AND Ce^{144} IN SEA ALGAE. G. G. Polikarpov (Kovalevskii Sevastopol Biological Station, Academy of Sciences, SSSR). *Doklady Akad. Nauk S.S.S.R.*, 140: 1192-4 (Oct. 11, 1961). (In Russian)

Samples of *Cystoseira barbata* and of a large brown seaweed from the Black Sea (*Cystoseira*) were grown in 2.5-liter, glass aquariums containing 10^{-5} curies/l of Sr^{90} and Ce^{144} (10^{-6} and 10^{-9} g/l respectively). The activity content of Sr^{90} and Ce^{144} was kept at the same level by adding 2.5×10^{-5} curies to each aquarium each day. Distribution coefficients were determined at different concentrations of activity in order to find out whether there was a variation in the distribution coefficient as a function of concentration. Equilibrium was attained in two days for Sr^{90} and in six days for Ce^{144} . It was found that the distribution coefficients remained constant for Sr^{90} , Y^{91} and Ce^{144} within the limits of experimental error. The distribution coefficients were found to be 300 for Sr^{90} and 2100 for Ce^{144} , and did not vary significantly whether the experiment was run with a single dose of tracer or with a multiple dose of tracer. Thus, the distribution coefficients were found to be stable in spite of

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a considerable variation in concentration of the isotopic carrier.

851

THE PATH OF ENTRY OF COBALT-60 INTO WHEAT SEED. Ivan D. Popov and V. Khristov. Compt. rend. acad. bulgare sci. 10, 73-6 (1957). CA-52: 7449a.

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SOME ASPECTS OF SUCROSE METABOLISM IN PLANTS. H. K. Porter and J. Edelman (Imp. Coll. Sci. Technol., London). Proc. Intern. Conf. Peaceful Uses At. Energy, Geneva, 1955, 12, 364-7 (1956). CA 53-9383g

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TRACING THE PATH OF THE TRANSPIRATION STREAM IN TREES BY THE USE OF RADIOACTIVE ISOTOPES. S. N. Postlethwait and Bruce Rogers. (Purdue Univ., Lafayette, Indiana). Am. J. Botany 45, 753-7 (1958). CA-53:6361g.

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INCORPORATION OF MEVALONIC ACID INTO TOMATO CAROTENOIDS. A. E. Purcell, G. A. Thompson, Jr., and James Bonner (California Inst. of Technol., Pasadena). J. Biol. Chem. 234, 1081-4 (1959). CA 53-15231g

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CYANIDE EFFECTS ON CARBON DIOXIDE FIXATION IN CHLORELLA. B. R. Rabin, D. F. Shaw, N. G. Pon, J. M. Anderson, and M. Calvin. (Univ. of California, Berkeley). J. Am. Chem. Soc. 80, 2528-32 (1958). CA-52: 18696g.

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SITE OF PROTEIN SYNTHESIS IN LEAVES. David Racusen and E. L. Hobson (Shell Develop. Co., Modesto, Calif.). Arch. Biochem. Biophys. 82, 234-6 (1959). CA 53-15230i

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RADIOISOTOPES IN SOIL-PLANT NUTRITION STUDIES. Proceedings of the Symposium held in Bombay, 26 February-2 March 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. June 1962. 469p. (STI/PUB/55). \$9.00; 189s.; NP 36; DM 31.50 (IAEA).

A symposium on Radioisotopes in Soil-Plant Nutrition Studies was held at Bombay, Feb. 26 to March 2, 1962.

Separate abstracts were prepared for 8 papers; abstracts of 2 papers have appeared previously in NSA. Other papers presented covered various aspects of soil chemistry, soil physics, ion uptake and translocation in soils, biological measurement of soil characteristics, and fertilizer usage.

858

SEASONAL ABSORPTION AND EXCRETION CYCLE OF PHOSPHORUS BY THE ROOT OF WOODY PLANTS. I. N. Rakhtenko. (Inst. Biol., Acad. Sci. White Russian S.S.R., Minsk). Fiziol. Rastenii, Akad. Nauk S.S.S.R. 5, 447-50 (1958). CA-53:3387h.

859

STUDIES ON THE DISCRIMINATION OF Sr^{90} FROM DIP-

LOID AND TETRAPLOID RED CLOVER AND Ca^{45} IN FEEDING EXPERIMENTS WITH MICE. Bertil Rasmuson and Bo Gahne (Inst. of Plant Systematics and Genetics, Uppsala), and Lars Fredriksson (National Agronomy Experiment Station, Uppsala). Kgl. Lantbruks-Högskol. Ann. 25, 241-51 (1959)

Diploid and tetraploid red clover was cultivated on different Ca levels with a constant addition of Sr^{90} in the soil. At all levels the diploid showed a greater uptake of both Ca and Sr^{90} per dry weight. The uptake of Sr^{90} from this diploid and tetraploid clover was investigated with mice as experimental animals on an adequate synthetic diet with calcium derived solely from the clover. There was no divergence in percentual uptake of Sr^{90} from the diploid clover and from the tetraploid, but the total difference in Sr^{90} activity that was found in the plant material was retained in the animal body. To the diet was added Ca^{45} to compare the strontium and calcium metabolism. The mice discriminated against strontium in relation to calcium ($OR_{body-diet} = 0.27$). The major discriminating factors were computed ($DF_{absorptive} = 0.45$ and $DF_{urine} = 0.58$). Consideration must be taken of the fact that Sr^{90} was derived from plant material.

860

INCORPORATION OF CARBON-14 INTO TOBACCO LEAVES WITH PARTICULAR REFERENCE TO POLYPHENOLS. W. W. Reid (Carreras, Ltd., London). Tabacco Sci. 3, 109-12 (Pub. in Tobacco 149, No. 4, 20-3 (1959). CA 53-19311d

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THE STIMULATORY EFFECT OF 3-INDOLEACETIC ACID ON THE UPTAKE OF AMINO ACIDS BY TISSUE OF HELIANTHUS ANNUUS. Leonora Reinhold and R. G. Powell. (Univ. Oxford, Engl.). J. Exptl. Botany 9, 82-96 (1958). CA-52: 18677g.

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METABOLISM OF CARBON-14-LABELED FERULIC ACID IN PLANTS. II. PARTICIPATION IN THE BIOGENESIS OF FLAVONOIDS. Hans Reznik and Rosmarie Urban. (Heidelberg Univ., Ger.). Naturwissenschaften 44, 592-3 (1957). CA-52: 93:5c.

863

TRACING CHANGES IN ISOTOPIC COMPOSITION OF Sr, Rb, Ca, K, AND Li WHEN ASSIMILATED BY PLANTS FROM THE NUTRIENT MEDIUM. G. R. Rick, O. N. Petrova, L. A. Misyuk, and L. V. Platonova (All-Union Lenin Academy of Agricultural Sciences, Leningrad). Biophysics (U.S.S.R.) (English Translation), 6: No. 6, 94-7 (1961).

The possibility of changes in the isotopic composition of Sr, Rb, Ca, K, and Li assimilated by plants from the nutrient medium was investigated in spring wheat, rice, tomato, and sunflower plants. A mass spectrometer was used to determine the isotopic composition of plant ashes and nutrient solution. Data are tabulated. No change in the isotopic composition was found for the elements tested when assimilated by plants from the nutrient medium.

864

MOVEMENT OF SEVERAL RADIOACTIVE ISOTOPES IN PEPPERMINT USING A SPLIT ROOT TECHNIQUE. Robert William Rinne (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., 22: 3361 (Apr. 1962).

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Studies were conducted with four objectives in mind: first, to point out the characteristics of a peppermint plant which make it ideally suited as a test plant for ion movement studies; second, to study the movement of several radioactive isotopes in a modified peppermint plant by feeding the isotopes to just two vascular bundles of the peppermint plant; third, to try and account for any gross differences in the movement of the radioactive isotopes used in the second portion of the study; fourth, to show the effects of varied phosphorus levels on the ultimate distribution of radioactive phosphorus in the peppermint plant. The first study showed that the peppermint plant can be modified to any number of oppositely paired leaves by removing the apical portion and the lateral shoots can be removed without influencing the basic pattern of ion movement in the plant. Also pointed out was the fact that any of the four main vascular bundles of the peppermint plant may be fed an isotope separately or in any combination.

In the second study three different patterns of movement were observed. The first pattern was distinct for iron-59, sulfur-35, zinc-65, and cobalt-60. These isotopes showed a distribution in the A', B' sections of the odd numbered leaves and in the A, A' sections of the even numbered leaves. The second type of pattern was distinct for chlorine-36. Chlorine-36 was distributed mainly in the A', B' sections of the odd numbered leaves. Some lateral movement of the chlorine-36 did take place into the A, B sections of the odd numbered leaves. The distribution of the chlorine-36 was quite irregular into the even numbered leaves. The third pattern of movement was distinct for rubidium-86 and calcium-45. These two isotopes were distributed in the A, B and A', B' sections of the odd numbered leaves. The even numbered leaves also contained the isotopes throughout the A, B and A', B' sections. The third study pointed out that the distribution of the calcium-45 into the A and B sections of the odd numbered leaves observed in the second study was due to a lateral movement of the calcium-45 out of the vascular bundles to which it was fed and into the vascular bundles which were not fed. The calcium-45 moved laterally only in the internode tissue. The fourth study pointed out that phosphorus-32 can be induced to move laterally to a phosphorus deficient area in the peppermint plant.

865 A/CONF.15/P/1295
RECHERCHES SUR LA PENETRATION DU ZINC DANS LES CARYOPSES ET LES SEMENCES AU MOYEN DE LEUR TRAITEMENT PAR $ZnSO_4$ MARQUE AVEC DU ZINC RADIOACTIF 65. (Research Into the Effect of Zinc on the Biological Processes of Some Plants with the Help of Radioactive Zinc (Zn^{65}).) R. Ripan, E. Pop, I. Ciobanu, T. Marco, and G. Marco (Université "Victor Babes," Cluj). 10p.

A study was made of the effect of small amounts of zinc on the growth of the seeds of some cereals. The study was conducted by varying the time and the zinc concentration. Zn^{65} -labeled $ZnSO_4$ was used. It was shown that the penetration of zinc into the caryopses and seeds was slow in *Zea mays* and more rapid in *Phaseolus vulgaris*. An increase in the uptake occurred in both cereals with an increase in the concentration of the solution. In a comparison of the zinc distribution, it was found that the pericarp of the caryopses of *Zea mays* retains a larger quantity than the seed tegument of *Phaseolus vulgaris*, and the endosperm a smaller quantity than the seed cotyledon.

866 INFLUENCE OF Ca AND Sr AMENDMENTS ON Sr^{90} UPTAKE BY LADINO CLOVER UPON PROLONGED CROPPING. E. M. Romney, G. V. Alexander, H. Nishita, and K. H. Larson (Univ. of California, Los Angeles). Soil Sci. Soc. Am. Proc., 25: 299-301 (July-Aug. 1961). (UCLA-462)

Prolonged cropping experiments showed that a single application of $CaCO_3$ in the amount recommended to produce better crop growth (2 to 5 tons an acre) continued to suppress Sr^{90} uptake from an acidic soil that initially was deficient in plant-available Ca. This effect of treatment is attributable to the complementary ion influence of Ca on Sr. The cumulative amount of Sr^{90} removed by 15 successive cuttings of ladino clover was 29.38, 15.71, and 11.61% of the dose from Sassafras sandy loam treated with $CaCO_3$ at levels of 1, 5, and 10 mc Ca per 100 g soil (equivalent to 0.5, 2.5 and 10 tons $CaCO_3$ an acre, respectively). The greatest amount of the Sr^{90} dose removed from the soil

by a single clover cutting was 0.38% at the 1 mc Ca treatment. A single application of $Sr(NO_3)_2$ amendment at levels of 0.05, 1, and 2 mc Sr per 100 g soil (equivalent to 0.05, 1 and 2 tons $Sr(NO_3)_2$ an acre) initially increased plant uptake of Sr^{90} from Hanford sandy loam as a result of the displacement of Sr^{90} from the exchange complex by stable Sr into the soil solution where it was more readily available to the plant. This enhancing effect of low levels of Sr amendment on Sr^{90} uptake became less apparent as time progressed. The carrier-dilution effect of reducing plant uptake of Sr^{90} from Hanford sandy loam was achieved by applying $Sr(NO_3)_2$ at a level of 10 mc Sr per 100 g soil (equivalent to 10 tons $Sr(NO_3)_2$ an acre).

867 INFLUENCE OF STABLE Sr ON PLANT UPTAKE OF Sr^{90} FROM SOILS. E. M. Romney, G. V. Alexander, G. M. le Roy, and K. H. Larson (Univ. of California, Los Angeles). Soil Sci. 87, 42-5 (1959) Jan.

Varied treatments of $Sr(NO_3)_2$ and $SrSO_4$ were applied to three different types of Sr^{90} -contaminated soil to determine to what extent stable Sr might reduce plant uptake of radiostrontium by the effect of carrier dilution. Applications of stable Sr at levels ranging from 0.1 to 5.0 me. Sr per 100 g. of air-dry soil increased the uptake of Sr^{90} by beans and Ladino clover. Stable Sr displaced Sr^{90} adsorbed on the soil exchange complex into the soil solution where it was more readily available to the plant. This effect was most apparent in an acidic soil containing a very low level of native Sr. Stable Sr uptake was linear with respect to the level of exchangeable Sr in the soil; however, the total amount of Sr accumulated by the plant was dependent upon the available soil calcium. Plants obtained more stable Sr from $Sr(NO_3)_2$ -treated soils than from $SrSO_4$ -treated soils. The levels of stable Sr required to effectively reduce plant uptake of Sr^{90} from soils by carrier dilution were greater than 5.0 me. Sr per 100 g. of soil, that is, equivalent to more than about 5 tons of Sr amendments an acre.

868 PLANT UPTAKE OF STRONTIUM-90, YTTRIUM-91, RUTHENIUM-106, CESIUM-137, AND CERIUM-144 FROM SOILS. E. M. Romney, J. W. Neel, H. Nishita, J. H. Olafson, and K. H. Larson. (Univ. of California, Los Angeles). Soil Sci. 83, 359-76 (1957). CA-52-4901g.

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- 869** ROOT TRANSFER OF FISSION PRODUCTS FROM CONTAMINATED SOIL. E. M. Romney, H. Nishita, J. H. Olafson, and K. H. Larson (Univ. of California, Los Angeles). *Soil Sci. Soc. Am. Proc.*, 27: 383-5 (July-Aug. 1963).
- Dry yield of wheat grown for 117 days was not affected by solutions of nuclear reactor-produced mixed fission products (MFP) applied to the soil surface or mixed with equal amounts of potted soil at contamination level ranging from 0.01 to 1.0 μC beta activity per g of soil. Concentrations of beta and gamma activity in the above-ground parts of plants were increased as the soil contamination levels increased. Wheat removed from 0.07 to 0.09% of the total beta activity that had been mixed with the soil and from 0.10 to 0.15% of that which had been applied to the soil surface. Concentrations of radioactivity in above-ground plant parts were highest in leaves, intermediate in stems and lowest in fruiting heads. Radiostromtium accounted for 50 to 80% of the beta activity transferred to above-ground plant parts; <10% was attributable to root transfer of Y^{91} , Ru^{106} , Cs^{137} , and Ce^{144} from soil
- 870** FORMATION OF OXALACETATE AND ASPARTATE FROM PHOSPHOENOL-PYRUVATE IN SPINACH LEAF CHLOROPLAST EXTRACT. Lawson L. Rosenberg, John B. Capindale, and F. R. Whatley. (Univ. of California, Berkeley). *Nature* 181, 632-3 (1958). CA-52:12093h.
- 871** FORMATION OF ALKYL PHOSPHATES IN WHEAT LEAVES. V. C. Runeckles. (Queen's Univ., Kingston, Can.). *Nature* 181, 1470-1 (1958). CA-52: 17422h.
- 872** ABSORPTION AND DISTRIBUTION OF STRONTIUM IN PLANTS. I. PRELIMINARY STUDIES IN WATER CULTURE. R. Scott Russell and Helen M. Squire (Univ. Oxford, Engl.). *J. Exptl. Botany* 2, 262-76 (1958). CA 53-11529d
- 873** A/CONF.15/P/287
THE AVAILABILITY TO PLANTS OF DIVALENT CATIONS IN THE SOIL. R. Scott Russell, R. K. Schofield, and P. Newbould (Agricultural Research Council, Grove, Berks, Eng.). 9p.
- Methods for characterizing the equilibrium soil solution are described and are applied to experiments in which soils used in pot culture experiments were labelled with Ca^{45} and Sr^{90} . Six soils showing a wide range of characteristics were used. In all soils the ratio of Sr^{90} to Ca^{45} or to stable calcium in the equilibrium solution was less than the ratio of exchangeable Sr^{90} to Ca^{45} or to stable calcium. The extent to which the ratios differed varied between soils. Three of the soils contained calcium carbonate which somewhat complicates the interpretation. Moreover, when calcium hydroxide was added to these soils varying amounts of calcium carbonate were precipitated. When this occurred after Ca^{45} had been added, some of it was precipitated with Ca^{45} . The ratio of strontium to calcium absorbed from soil by barley and cabbage showed reasonable agreement with that observed when the plants were grown in nutrient solutions similar in composition to the equilibrium soil solution.
- 874** RATE OF ENTRY OF RADIOACTIVE STRONTIUM INTO PLANTS FROM SOIL. R. Scott Russel and G. M. Milbourn (Agricultural Research Council Radiobiological Lab., Compton, Nr. Newbury, Berks). *Nature* 180, 322-4 (1957) Aug. 17.
- 875** UPTAKE OF STRONTIUM BY PASTURE PLANTS AND ITS POSSIBLE SIGNIFICANCE IN RELATION TO THE FALLOUT OF STRONTIUM-90. R. S. Russell and R. J. Garner. *Nature (Lond)* 183, 1806-7 (1959) June
- 876** DISTRIBUTION OF STRONTIUM ABSORBED BY RICE PLANT AT DIFFERENT STAGES OF GROWTH. Takashi Sakaguchi, Zenzaburo Kasai, and Azuma Okuda. (Kyoto Univ.). *Mem. Research Inst. Food Sci. Kyoto Univ.* No. 15, 12-15 (1958). CA-53: 5051.
- 877** (UCRL-Trans-737) INCORPORATION OF O^{18} FROM HEAVY OXYGEN WATER IN VIOLAXANTHENE UNDER THE EFFECT OF LIGHT ON PLANTS. D. I. Sapozhnikov, D. G. Alkhazov, Z. M. Eidel'man, N. V. Bazhanova, I. Kh. Lemberg, T. G. Maslova, A. B. Girshin, I. A. Popova, V. S. Saakov, O. F. Popova, and G. A. Shiryaeva (Shiriaeva). Translated by S. Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from *Botan. Zhur.*, 46: 673-6 (1961). 12p.
- The investigation was conducted on *Elodea canadensis* and *Chlorella pyrenoidosa* using heavy-oxygen water of 17 and 23% enrichment, respectively. The plants were: I. exposed to heavy-oxygen water and light; II. exposed to heavy-oxygen water and darkness; and III. ordinary water and light. The violaxanthene was extracted from the plants and exposed to protons to convert the incorporated O^{18} to F^{18} . The F^{18} was detected in I., and not detected in II. and III.; thus indicating that light causes the plant to take up the O^{18} and incorporate it in the violaxanthene
- 878** FORMATION OF HOMOSERINE DURING GERMINATION OF THE PEA. Kei Sasaoka. (Kyoto Univ.). *Mem. Research Inst. Food Sci., Kyoto Univ.* No. 14, 42-8 (1958). CA-52: 11192d.
- 879** TRANSFORMATION OF THIOUREA- S^{35} IN POTATO TUBERS. N. A. Satarova. (K. A. Timiryazev Inst. Plant Physiol., Moscow). *Doklady Akad. Nauk S.S.S.R.* 122, 528-31 (1958). CA-53: 1473f.
- 880** STRONTIUM-90 UPTAKE BY UNDERGROUND PLANT PARTS. E. L. Sattler. p.112-15 of "Radiostromtium." Strahlenschutz No. 18. Munich, Gersbach & Sohn Verlag, 1961.
- Since 1957 potato and soil samples have been taken from ten different soil types in Hesse. The Sr^{90} contamination of the underground plant constituents was determined, the motion of the activity was followed during the year, and the effect of the various soils was determined. The results obtained showed that the separation factor (observed ratio) generally increases with the Ca concentration. The dependence of the observed ratio on the ratios Ra/Ca or Sr/Ca in the soil is given. The results only illustrate the tendency that a preferred Sr uptake is connected with increasing Ca content.

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- 881** (AEC-tr-4353) LABELING OF PLANTS WITH C^{14} . D. Sauerbeck. Translated by Lydia Venters (Argonne National Lab.) from Atompraxis No. 6: 221-5(1960). 13p.
This paper was previously abstracted from the original language and appears in NSA, Vol. 14, as abstract No. 22724.
- 882**
THE BEHAVIOR OF STRONTIUM-90 IN SOILS AND PLANTS AND AGRICULTURAL PRECAUTIONS FOR LESSENING THE STRONTIUM-90 CONTAMINATION OF FOOD. F. Scheffer and F. Ludwig (Univ. of Göttingen, Ger.). Atompraxis 4, 416-19(1958). (In German)
The development of dirty atom bombs (hydrogen bombs with a uranium mantle) and the resultant high radioactive fall-out have made the strontium-90 contamination of foodstuffs a serious problem for humanity. The literature of recent years is used to survey the behavior of strontium-90 in plants and soil, and to discuss agricultural measures which could be taken to lessen the contamination of foodstuffs in case of atomic warfare.
- 883** CEA-tr-A-661
COMPORTEMENT DU STRONTIUM 90 DANS LE SOL ET LA PLANTE. MESURES AGRICOLES EN VUE DE DIMINUER LA CONTAMINATION DES PRODUITS ALIMENTAIRES. (Behavior of Strontium-90 in Soil and Plants. Agricultural Methods for Lowering Contamination of Food Products). F. Scheffer and F. Ludwig. Translated into French from Atompraxis 4, 416-19(1958). 15p.
This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4408.
- 884**
INFLUENCE OF LIGHT ON P_2O_5 UPTAKE BY SEEDLINGS. F. Scheffer, A. Kloeke, and H. Folster. (Univ. Göttingen, Ger.). Plant and Soil 8, 194-8(1957)(in German). CA-52: 16483f.
- 885** A/CONF.15/P/989
USE OF ^{32}P FOR INVESTIGATIONS IN THE SYSTEM SOIL-SOIL SOLUTION-PLANT. F. Scheffer and B. Ulrich (Univ. of Göttingen, Ger.). 8p.
The use of P^{32} in pot experiments allows the calculation of the amount of nutrient in the plant, coming from the fertilizer, the percentage of the fertilizer taken up by the plant, the isotopic exchangeable soil phosphorus, and the percentage of water insoluble fertilizer which has reacted with the soil solution. Examples are discussed. The validity of isotope dilution equation in pot experiments is discussed, partly in connection with reversible phosphorus exchange between plant and soil and nutrient solution. Kinetic studies are described on determination of isotopic exchangeable soil phosphorus in three or more reactions, which are characterized by the reaction half-time and the amount of phosphorus involved. The processes responsible for the availability of nutrients in soil are discussed briefly.
- 886**
ZINC UPTAKE IN ALFALFA. W. G. Schrenk, Delbert A. Naumann, and R. E. Hein. (Kansas Agr. Expt. Sta., Manhattan). Trans. Kansas Acad. Sci. 50, 71-7(1957). CA-52: 20411h.
- 887** (TID-15982) CARBON-14 FIXATION IN POLLEN OF YELLOW LUPINE (LUPINUS LUTEUS LINN.). William G. Schwen, John C. Frazier, Herbert C. Moser, and James A. Gess (Kansas. Agricultural Experiment Station, Manhattan). [nd]. Contract AT(11-1)-1015. 12p.
Carbon-14 fixation studies were made on germinated pollen of yellow lupine to ascertain whether the chlorophyll reported to be in these grains was functional photosynthetically. Light and dark exposures to atmospheres containing 20 and 500 μc of carbon-14 labeled carbon dioxide were made for 1.5 and 45 minutes, respectively. The exposed pollen was extracted in 80% ethanol, the resulting extract reduced in volume, and chromatographed two dimensionally. When the chromatograms were cut into numbered small squares and their activity counted in an automatic sample counting system, a marked similarity was observed in the pattern of radioactivity from all exposures. Eluting and co-chromatographing this activity from the squares, with known standards, demonstrated labeling to be specific to certain intermediates of the Krebs cycle and their derived amine acids. The labeling in these intermediates and the absence of labeling in photosynthetic metabolites is strong evidence that only respiratory fixation of carbon-14 occurs in the germinated pollen of this variety of yellow lupine under the conditions of the experiment.
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MALONATE METABOLISM OF PLANT TISSUES. Leland M. Shannon, Roger H. Young, and Carlton Dudley (Univ. of California, Los Angeles). Nature 183, 683-4(1959). CA 53-16288b
- 889**
THE REACTION OF PLANTS TO THE RADIATION EFFECT OF S^{35} IN THE FIRST AND SECOND GENERATIONS. A. G. Shestakov, G. F. Ivanova, and N. I. Shmel'kova. Izvest. Timiryazev. Sel'skokhoz. Akad. 4, 29-40(1958). CA-52: 20417g.
- 890**
RANDOMIZATION OF THE CARBON ATOMS IN GLUCOSE AND FRUCTOSE DURING THEIR METABOLISM IN BARLEY SEEDLINGS. S. Shibko and J. Edelman. (Imp. Coll., London). Biochim. et Biophys. Acta 25, 642-4(1957)(In English). CA-52-1376h.
- 891**
ALANINE IN PLANT METABOLISM. E. A. Shilov and A. A. Yasnikov (Inst. Org. Chem., Acad. Sci. Ukr. S.S.R., Kiev). Doklady Akad. Nauk S.S.S.R. 124, 459-61(1959). CA 53-9378f
- 892**
THE EFFECT OF BORON ON THE RATE OF INCORPORATION OF P^{32} BY THE NUCLEIC ACIDS OF THE SUNFLOWER. M. Ya. Shkol'nik and A. V. Kositsyn (V. L. Komarov Botanical Inst., USSR). Doklady Akad. Nauk S.S.S.R., 144: 662-4(May 21, 1962). (In Russian)
Six sunflower plants were grown from seed in a vessel 1.8 liters in volume on a Knop solution with and without boron. In 9 to 14 days the plants were transferred to a Knop solution of the same composition, containing phosphate tagged with P^{32} (10 to 40 μc of P^{32} tracer per vessel). Analyses of RNA and DNA were then made in 2 to 4 days on the roots, stems, cotyledons and upper leaves of the plants. The specific activities of the P^{32} in the nucleic acid fractions were determined. The analyses show that a

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boron deficiency slows down the synthesis of nucleic acids, especially in the parts of the plant where the growth of new tissue is intensive. The specific activity of the P^{32} in the nucleic acid fractions is about a factor of 10 higher when boron is fed to the plant. The results show that boron plays an important role in the synthesis of the nucleic acids.

893

RATIO BETWEEN BIOSYNTHESIS OF CHLOROPHYLL A AND CHLOROPHYLL B IN THE PROCESS OF RENEWAL METABOLISM. A. A. Shlyk, T. N. Godnev, R. M. Rotfarb, and Ya. P. Lyakhovich. *Byull. Inst. Biol., Akad. Beloruss. S.S.R.* 1956, No. 2, 59-64 (Pub. 1957). CA-52: 20438e.

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RENEWAL OF CHLOROPHYLL COMPONENTS IN THE PROCESS OF ACCUMULATION. A. A. Shlyk, T. N. Godnev, Ya. P. Lyakhovich, R. M. Rotfarb, and V. I. Yunevich. *Byull. Inst. Biol. Akad. Nauk Beloruss S.S.R.* 1956, No. 2, 64-71 (1957). CA-53: 1474d.

895 A/CONF.15/P/980

THE UPTAKE OF ZINC AND STRONTIUM IN VITIS VINIFERA. O. Siegel and W. Goerke (Pflanz. Landw. Untersuchungs- und Forschungsanstalt Speyer/Rhein). 11p.

Data are reported from a study of zinc-65 uptake by grape vines. A method is described for measuring the rate of intake of trace amounts of chemicals by plants. It is suggested that the method may also be used for measuring the rate of deposition of fall-out on plant surfaces.

896 THE INTRODUCTION OF TRITIUM IN SOME SUGARS DURING PHOTOSYNTHESIS. H. Simon and A. Trebst (Technische Hochschule, Munich). *Z. Naturforsch.*, 16b: 285-7 (Apr. 1961). (In German).

A study was made on chloroplasts and chlorella to determine how much T was bound during photosynthesis per $C^{14}O_2$ fixed. The sugar phosphate isolated and identified through paper chromatography and autoradiography were dephosphorylated, and the free sugar was rechromatographed and eluted. The tritium and C^{14} were determined. The C^{14}/T ratio found in the sugars was compared with the C^{14}/T ratio in the bicarbonate- C^{14} and HOT used. The results are tabulated for various sugars. The C^{14}/T ratio in the photosynthetic products is smaller than in the substrate. This indicates an enrichment in tritium. In chlorella only half as much T is bound as in chloroplasts.

897

ON THE SYNTHESIS OF TRITIUM IN SOME SUGARS IN PHOTOSYNTHESIS. H. Simon and A. Trebst. *Z. Naturforsch.* 16B, 285-7 (1961) Apr.

898

PHOTODEPENDENT PHOSPHORYLATION. VII. THE EFFECT OF MONOIODOACETIC ACID ON THE FORMATION OF PHOSPHORUS-32-MARKED PHOSPHORYLATED COMPOUNDS IN ELODEA DENSA (PHOSPHOGLYCERIC ACID AN INTERMEDIATE PRODUCT OF PHOTOSYNTHESIS?). W. Simonis and G. Weichart (Tierärztlichen Hochschule, Hannover, Ger.). *Z. Naturforsch.* 13b, 694-6 (1958). CA 53-93671

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PHOSPHORYLATION DEPENDENT ON LIGHT. V. THE METHODOLOGICAL QUESTIONS ON THE EXTRACTION AND PAPER CHROMATOGRAPHY OF PHOSPHORUS-32-LABELED COMPOUNDS FROM ALGAE. Wilhelm Simonis, Horst Kating, and Gunter Kues. (Tierärztliche Hochschule, Hannover, Ger.). *Z. Naturforsch.* 12b, 812-13 (1957). CA-52: 14749h.

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QUANTITATIVE DETERMINATION OF THE FORMATION OF PHOSPHORUS-32-LABELED PHOSPHORYLATED COMPOUNDS IN ELODEA. W. Simonis and G. Weichart. (Botan. Inst., Hannover, Ger.). *Z. Naturforsch.* 13b, 55-7 (1958). CA-52: 8296d.

901

A COBALT MACHINE FOR SEMI-ACUTE IRRADIATION OF GROWING PLANTS. W. R. Singleton, A. Caspar, and W. S. Flory, Jr. (Univ. of Virginia, Boyce). *Intern. J. Appl. Radiation and Isotopes*, 10: 47-54 (Feb. 1961). (In English)

A Co^{60} machine for irradiating growing plants with gamma rays is described. The 200-c machine is shielded behind earthen bunkers with concrete retaining walls, also a sky-shine shield intercepts vertical radiation. The radiation level at the control house, 100 ft away, is 2 mr/hr. The source is held in place by an electromagnet which is raised and lowered by a windlass in the control house by means of a stainless-steel cable. In case of power failure the Co^{60} source drops into the lead container in the center of the field. Either seeds, plants, or other biological specimens may be treated. Doses ranging from 7000 r/hr at 20 cm to 1 r/hr at 20 m may be used. At 1 m the dose is 310 r/hr or approximately 7300 r for a 23.5 hr day. A dose of 1000 r is sufficient for inducing many mutations in plant material. This can be obtained in 23.5 hr at about 3 m from the source.

902

THE SYNTHESIS OF NUCLEIC ACIDS AND PROTEINS IN THE NUCLEI OF TRADESCANTIA ROOT TIPS. Jesse E. Siskin. (Med. Research Inst., Duarte, Calif.). *Proc. Intern. Congr. Genetics*, 10th, Montreal, 1958, 2, 262 (1958). CA-52: 20458c.

903

THE Sr^{90} CONTENT OF DIFFERENT GRASSLAND SAMPLES IN THE FEDERAL DISTRICT IN RELATION TO Sr^{90} CONTENT OF THE SOIL. Albert Sittkus (Universität, Freiburg i. B.) and Erwin Welte (Landwirtschaftliche Forschungsanstalt Buntshof, Hanover). *Naturwissenschaften* 46, 399-400 (1959) (In German)

The Sr^{90} content of plant materials was determined and compared to Sr^{90} content of the soils from which they were taken. Plotting plant Sr^{90} on the y-axis and soil Sr^{90} on the x-axis gives a straight line: $y = 0.173x + 0.70$.

904

FIXATION OF CARBON DIOXIDE- C^{14} INTO TARTARIC AND MALIC ACIDS OF EXCISED GRAPE LEAVES. Helen A. Stafford and Frank A. Loewus. (Reed Coll., Portland, Oregon). *Plant Physiol.* 33, 194-9 (1958). CA-52: 14772i.

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PHOSPHORUS METABOLISM IN HEALTHY AND DISEASED FRUIT AS DETERMINED BY RADIOACTIVE PHOSPHORUS (PHOSPHORUS-32). D. Stankovic and A. Becarevic. (Fac. Agr., Belgrade, Yugoslavia). Intern. Hort. Congr., 14th, The Hague-Scheveningen 1, 786-95(1955). (in English). CA-52: 17400a.
- 906**
A STUDY OF MICROAUTORADIOGRAPHY OF THE DISTRIBUTION OF TRITIUM-LABELED GLYCINE IN RUSTED PINTO BEAN LEAVES. Richard C. Staples and Myron C. Ledbetter. *Contribs. Boyce Thompson Inst.* 19, 349-54(1958). CA-52: 20445b.
- 907** THE EFFECT OF TRITIATED THYMIDINE ON THE MORPHOGENESIS OF LATERAL ROOTS. O. L. Stein (Montana State Univ., Missoula) and H. Quastler. p.149-53 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Energy Agency, 1962. (BNL-5333). (In English)
Along the axis of a primary root exists a series of successive developmental stages of the same organ—the lateral root, a system ideal for assaying effects of various agents on organogenesis. Primary roots of several species grown in H^3 -thymidine in various concentrations and for different periods of time show a region devoid of lateral roots which corresponds closely to the region of differentiation at time of treatment. Anatomical analysis combined with autoradiography indicates that "hot" pericycle cells may be capable of 1 or 2 cell divisions before further development of the lateral root is inhibited. There is evidence that a minimum number of cells must be affected before substitution by adjacent cells is eliminated. This may be a function of the length of the cell division cycle and thus prescribe the duration of treatment for the desired morphological effect. Root primordia already established at time of treatment do not appear affected if the amount of radioactivity is chosen discriminately. In *Zea mays* the effect of "nuclear irradiation" on differentiation was compared with the effect of x rays and gamma irradiation (Co^{60}). In general, the external irradiation results in a more diffuse disturbance of both lateral and primary root growth. When duration of exposure and dose of an external source are properly chosen the internal effect of tritiated thymidine can be approached. The system offers opportunity to discriminate between damage due to nuclear irradiation (genetic effects?) and general irradiation (genetic + physiological?). *Pisum sativum* and *Cucumis sativus* were also used. Current work involves autoradiography to determine the amount of chromosomal radiation needed to disturb these developmental processes.
- 908** (BNL-6570) THE EFFECTS OF CHRONIC GAMMA IRRADIATION ON THE GROWTH OF *KALANCHOE* cv. "BRILLIANT STAR." O. L. Stein and A. H. Sparrow (Montana State Univ., Missoula and Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-gen-16]. 51p.
Kalanchoe seedlings were exposed to 330 r/20 hr/day from a Co^{60} source. Samples were harvested weekly. No new leaves were produced after initial exposure to irradiation. Mitosis in the apical meristem appears to have been suppressed. However, the axillary meristems and the cambium continue their activity. This results in a much broadened stem tip with enlarged cells, supported by a stout internode in which cell size has remained relatively normal but cell number has increased. After about 26 days of exposure, meristematic activity in the shoot apex region appears to resume. This results in the formation of growth centers which can give rise to leaves or malformed structures. The original phyllotaxy is not recovered. It is suggested that this resumption of growth may be an instance of adaptation to irradiation. In a second investigation the effect of chronic irradiation at various dose rates and on plants of different ages was tested. The dose rates used were 10, 25, 50, 100, and 250 r/20 hr/day. Plants were in leaf stage 6, 8, 11, and 16 at the beginning of the experiment. No obvious age effect could be determined over this range of leaf stages. At 10 and 25 r/day rate of leaf production does not appear to be affected. At 50 r/day about 5 more leaf pairs are formed before normal activity of the apical meristem ceases. In heavily irradiated plants leaves tended to be larger, broader, and heavier. Much of this is the result of more cells rather than larger cells. Internodes which are formed during irradiation show a reduction in length, largely because fewer cells are formed. The degree of reduction is dose dependent.
- 909**
NITROGEN METABOLISM; RESPIRATION, AND GROWTH OF CULTURED PLANT TISSUE. IV. THE IMPACT OF GROWTH ON PROTEIN METABOLISM AND RESPIRATION OF CARROT TISSUE EXPLANTS. GENERAL DISCUSSION OF RESULTS. F. C. Steward (Cornell Univ., Ithaca, N.Y.) and R. G. S. Bidwell. *J. Exptl. Botany* 9, 285-305(1958). CA 53-11529i
- 910** (HW-69500(p.92-6)) EFFECT OF SOIL MOISTURE ON UPTAKE AND TRANSLOCATION OF CESIUM-137 AND POTASSIUM IN BEAN PLANTS. J. D. Stewart (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).
Increasing soil moisture tension increased plant uptake of Cs^{137} to a greater extent than K. Ratio of Cs^{137} to K showed values as high as four for some plant tissue. The addition of carrier Cs and NPK to the soil did not significantly alter the effect of soil moisture tension on Cs^{137} and K uptake.
- 911** (HW-65500(p.37-41)) INFLUENCE OF SOIL MOISTURE ON ION UPTAKE BY BEAN PLANTS. J. D. Stewart. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
Variation in available soil water did not influence plant uptake of Ca^{45} and Sr^{85} but were found to influence Cs^{137} and potassium uptake. Cesium-137 uptake was increased to a greater extent than potassium at the lower moisture levels. Both potassium and Cs^{137} were concentrated more in stems than in leaves as available soil moisture decreased, suggesting reduced translocation to the leaves or translocation from the leaves to the stems.
- 912** TID-7554(p.487-503)
California. Univ., Berkeley. Kearney Foundation of Soil Science.
USE OF RADIOISOTOPES IN PLANT NUTRITION STUDIES. P. R. Stout and T. C. Broyer. p.487-503 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NU-

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CLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 17p.

Applications of radioisotopes in research on plant nutrition are reviewed. Related subjects such as soil chemistry, entomology, plant pathology, genetics, and plant physiology are also discussed.

913

CHOROPLAST PIGMENTS OF DEUTERATED GREEN ALGAE. H. H. Strain, H. L. Crespi, and J. J. Katz. *Nature (Lond)* **184** (Suppl. 10) 730-1 (1959) Aug. 29?

914

CHLOROPLAST PIGMENTS AND PHOTOSYNTHESIS IN DEUTERATED GREEN ALGAE. H. H. Strain, M. R. Thomas, H. L. Crespi, M. I. Blake, and J. J. Katz (Argonne National Lab., Ill.). *Ann. N. Y. Acad. Sci.*, **84**: 617-33 (Nov. 25, 1960).

The isolation and characterization of deuterio-chlorophylls *a* and *b* from the chloroplasts of fully deuterated green algae, together with some preliminary observations on photosynthesis in deuterated algae, are described. An improved procedure is given for the isolation and purification of the chlorophylls. The algae used in the study were cultured for more than a year in a nutrient solution prepared from 99.8% D₂O. The infrared studies reported provide independent evidence that the chlorophyll made by the algae is essentially free of hydrogen. The ratio of deuterio-chlorophyll *a* to *b* in crude extracts of the deuterated algae was determined to be in the range 1.5:1 to 2:1. The uptake of NaHC¹⁴O₃ by ordinary and deuterated *C. vulgaris* in H₂O and D₂O were measured, and the results are tabulated.

915

DEUTERIOCAROTENOID PIGMENTS FROM FULLY DEUTERATED GREEN ALGAE. H. H. Strain, M. R. Thomas, H. L. Crespi, and J. J. Katz. *Biochim. Biophys. Acta* **52**, 517-26 (1961) Sept.

916

ASSIMILATION OF NITROGEN-15 FROM LABELED HYPONITRITE BY SOYBEAN LEAVES. D. Stuart Frear and R. C. Burrell. (Ohio State Univ., Columbus). *Plant Physiol.* **33**, 105-9 (1958). CA-52: 10301e.

917

THE EFFECT OF pH ON THE ABSORPTION OF Sr⁸⁹, P³², AND Fe⁵⁹ IONS BY LEAVES OF *ZEAMAYS*. T. W. Sudia and A. J. Linck (Univ. of Minnesota, St. Paul). *Ohio J. Sci.*, **61**: 107-12 (Mar. 1961).

The absorption and translocation of phosphorus-32, iron-59, and strontium-89 by the leaves of 10-day-old corn plants were studied as functions of pH. The pH of the solution in which the mineral ion is supplied to the corn plants had a significant effect on absorption. For the three mineral ions studied, greater absorption occurred at the lower pH values of 2.5 and 4.5 and significantly lower amounts were absorbed at the higher pH values of 7.0 and 8.2. All three mineral ions are readily absorbed by the leaves of corn but they differ markedly in the amount of each ion transported from the leaves. For the isotope of phosphorus, between 10 and 18% of the total activity in the plant is found in the stem and leaves following transport from the applied leaf. These figures can be compared to from 45 to 67% of the iron translocated. Less than 2% of the radiostrontium was transported from the applied leaf

918

FERMENTATION OF GLUCOSE BY *CHLORELLA VULGARIS*. P. J. Syrett (Univ. Coll., London). *Nature* **182**, 1734-5 (1958). CA 53-11501i

919

UTILIZATION OF UNIFORMLY LABELED C¹⁴-GALACTOSE BY ETIOLATED AVENA COLEOPTILES. Kenneth V. Thimann, J. Craigie, G. Krotkov, and Lillian Cowie. (Harvard Univ.). *Am. J. Botany* **45**, 295-7 (1958). CA-52: 13027d.

920

ON THE EFFECT OF ETHYLENEDIAMINETETRAACETATE (EDTA) ON THE ACCUMULATION COEFFICIENT OF DIFFERENT RADIOISOTOPES FROM AQUEOUS SOLUTION BY FRESH-WATER PLANTS. E. A. Timofeeva-Resovskaya, and N. V. Timofeev-Resovskii (Inst. of Biology, Urals Div., Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.* **130**, 210-13 (1960) Jan. 1. (In Russian)

The effects of ethylenediaminetetraacetate on the accumulation coefficients of Ce¹⁴⁴, Co⁶⁰, Cs¹³⁷, Fe⁵⁹, Nb⁹⁵, Ru¹⁰⁶, S³⁵, Sr⁹⁰, Y⁹¹, Zn⁶⁵, and Zr⁹⁵ from aqueous solutions were studied. Eight grams of elodea (*Elodea canadensis* Rich.), aquatic plant (*Ceratophyllum demersum* L.), duckweed (*Lemna minor* L.), and chara (*Chara fragilis* Desw.) were placed in three liters of water containing 400 mg of EDTA per liter. Tabulated data show 4 groups of isotopic reactions to EDTA. The first group includes strontium and cesium (whose uptake increases in the presence of EDTA), the second is represented by sulfur (which does not react to EDTA), the third group consists of zirconium, niobium, and ruthenium (whose uptake is reduced 2 to 3 fold in the presence of EDTA), and the fourth group contains iron, cobalt, zinc, yttrium, and cerium (whose uptake is reduced 10 to 100 fold).

921

SOME EFFECTS OF GAMMA-IRRADIATION ON BARLEY AND ITS MALTING PROPERTIES. K. H. Tipples and F. W. Norris (Univ. of Birmingham, Eng.). *J. Sci. Food Agr.*, **14**: 646-54 (Sept. 1963).

Irradiation of barley above and below disinfestation levels (16,000 rads) was carried out to study the effects of irradiation and post-irradiation storage on malting properties. Maltose figures and free β -amylase of raw barley increased at low irradiation levels. Respiration rate and rootlet production decreased slightly with increasing irradiation, while malts produced from barley irradiated below 100,000 rads showed little change in α - and β -amylase and in proteinase activities. The effects on micro- and pilot-scale malted barley were sometimes in sharp contrast. Growth of barley seedlings demonstrated that unevenness caused by irradiation was more marked in the plumules than in the roots. Plant height, but not root length, showed the reversal effect. Standard analyses of pilot-scale malts indicated a slight degree of undermodification after irradiation. Technological implications of the irradiation process for disinfestation are discussed.

922

ON CONDITIONS OF DETECTION OF HIDDEN DEFECTS IN THE STRUCTURE OF DNA IN SEED FOLLOWING GAMMA IRRADIATION. V. I. Tokarskaia. *Radiobiologia* **2**, 161-5 (1962)

923

METABOLISM OF ACETATE-1-C¹⁴ ENTERING THE PLANT VIA THE ROOT SYSTEM. V. I. Tokarskaya

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and A. M. Kuzin. *Biochemistry (U.S.S.R.)* 21, 839-49(1956)(English translation). CA-52: 11195b.

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ABSORPTION AND TRANSLOCATION OF PHENYL-MERCURICACETIC ACID IN THE RICE PLANT. Chojiro Tomizawa. (Nat'l. Inst. Agr. Sci., Nishigahara). *Nippon Shokubutsu Byori Gakkaiho* 22, 45(1957). CA-52: 14951i.

925

ON THE CAUSE OF ASYMMETRICAL C¹⁴ DISTRIBUTION IN HEXOSE DURING PHOTOSYNTHESIS WITH CHLOROPLASTS. A. Trebst and F. Fiedler. *Z. Naturforsch* 17B, 553-8(1962) Aug.

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SEPARATION OF LIGHT AND DARK PHASES IN PHOTOSYNTHESIS OF ISOLATED CHLOROPLASTS. Achim V. Trebst, Harry Y. Tsujimoto, and Daniel I. Arnon. (Univ. of California, Berkeley). *Nature* 182, 351-5(1958). CA-53: 3385f.

927

BIOLOGICAL ACTION OF NEUTRONS ON PLANTS. S. F. Tselischev and V. B. Mogilevkin. *Izvest. Timiryazev. Sel'skokhoz. Akad.* 1957, No. 3, 33-51. CA-52: 7439e.

928

UTILIZATION OF NITROGEN-15 FOR INVESTIGATION OF PLANT METABOLISM IN RELATION TO AGE OF THE PLANT, TIME OF INTRODUCTION OF FERTILIZERS, AND THEIR DOSES. V. V. Tserling, G. M. Shcheglova, E. G. Plyshevskaya, and V. V. Zertsalov. (V. V. Dokuchaev Soil Inst., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rastenii* 4, 3-13(1957). CA-52: 12095c.

929

BIOCHEMICAL STUDIES ON TOBACCO ALKALOIDS. I. FATE OF LABELED TOBACCO ALKALOIDS SUPPLIED TO NICOTIANA PLANTS. T. C. Tso and R. N. Jeffrey (Univ. of Maryland, College Park). *Arch. Biochem. Biophys.* 80, 46-56(1959). CA 53-11537g

930

NITROGEN EXCHANGE IN PLANTS, USING NITROGEN-15. F. V. Turchin, M. A. Guminskaya, and E. G. Plyshevskaya (Ya. V. Samoilov Sci. Research Inst. Fertilizers and Insectofungicides, Moscow). U.S. At. Energy Comm. AEC-tr-3376, 65-80(1957). CA 53-9374i

931 (ANL-6464(p.116-27)) INCORPORATION OF 2-C¹⁴-GLUTAMIC ACID INTO PEPTIDES AND PROTEINS OF CELL-FREE HOMOGENATES OF PEA SEEDS. James E. Turner (Argonne National Lab., Ill.).

Pea seeds contain ninhydrin-positive material that yields amino acids following hydrolysis with hydrochloric acid. In cell-free homogenates of pea seeds more glutamic acid is incorporated into this material during the first hour of incubation than into the bulk protein fraction. It is not possible at present to state whether this peptide material is subsequently incorporated into protein; however, the data are consistent with the hypothesis that peptides serve as intermediates in protein synthesis in pea seeds.

932

THE INFLUENCE OF SEED STORAGE ON THE TERMINAL EFFECT OF GAMMA IRRADIATION (Co⁶⁰). M. M. Tushnyakova. *Tr. Inst. Genet., Akad. Nauk SSSR*, No. 29, 185-93(1962).

Seeds of two varieties of oats, *Avena sativa* and *A. nuda*, were treated with x-ray doses ranging from 15000 to 30000 r. In the case of *A. nuda*, seed of the previous harvest and seed stored for 5 years were used but only fresh seed of *A. sativa* was treated. One portion of the 5-year old *A. nuda* was irradiated on April 7, 1958, and sown 4 weeks later together with control non-irradiated seed. The 15 kr dose slightly reduced germination and survival and induced morphological and physiological variability. Although the seeds set, their yield was markedly lower than in the controls. The effects were augmented when higher doses were applied. Germination was reduced by approximately 10% for each 5 kr increment in dose. In contrast, the reduction in survival with increasing dose displayed geometric progression, falling from 80% at 15 kr to 27.55 at 20 kr and 0.5% at 25 kr. The control material showed 90.5% germination and 99.4% survival. A similar pattern was observed when fresh *A. nuda* seed of the previous harvest was irradiated and then stored for two years. Subsequent sowing tests showed that the germination and survival capacity of the material gradually decreased during storage, particularly when higher dosage rates were used. Similar results were obtained with *A. sativa* seed. Thus when seed was exposed to 25 kr and stored for 14 months, survival capacity was nil, except when gibberellic acid or various other chemicals were used to treat seed after irradiation, in which case 1-3% survival was noted.

933

(HW-65500(p.42-8)) INSOLUBILITY AS A FACTOR IN Sr⁹⁰ AVAILABILITY TO PLANTS. R. L. Uhler. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

The uptake of Sr⁹⁰ from compounds of varying solubility which were mixed in soils was followed over an extended period. Differences in uptake suggests that Sr⁹⁰ in the presence of phosphate and calcium carbonate are fixed in the formation of hydroxyapatite. Massive applications of phosphate to a calcareous soil contaminated with soluble Sr⁹⁰ reduced Sr⁹⁰ uptake and supports hydroxyapatite fixation of Sr⁹⁰.

934

(HW-69500(p.103-7)) MECHANISM OF CALCIUM-STRONTIUM DISCRIMINATION IN PLANTS. R. L. Uhler, O. Biddulph, and F. P. Hungate (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Bean plants were grown in nutrient solution to which Ca⁴⁵ and Sr⁸⁵ were added. Relative concentrations of these isotopes in different plant parts were observed to change with time. The more rapid initial movement of Sr⁸⁵, compared to Ca⁴⁵, to leaves was assumed to be due to Ca⁴⁵ exchange with stable calcium pre-existing in stems and roots.

935

HW-59500(p.33-40) General Electric Co. Hanford Atomic Products Operation, Richland, Wash. INFLUENCE OF CALCIUM ON Sr⁹⁰ UPTAKE. R. L. Uhler. 8p.

Available calcium was the most significant factor studied which reduced uptake by plants of radiostrontium from soil. Time to equilibrate insoluble and soluble forms of strontium in soil was found to be long. Slight

REFERENCES

differences in relative concentrations of Sr^{85} and Ca^{45} were noted in different plant parts.

936

EFFECT OF VARIOUS TYPES OF NITROGEN ON THE PRODUCTS OF ASSIMILATION OF LEAVES AND THEIR DISTRIBUTION BETWEEN EPIGEAL AND ROOT ORGANS IN CORN. S. G. Vaklinova, N. G. Doman, and B. A. Rubin (Inst. Plant Growing, Bulgarian Acad. Sci., Sofia). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 5, 516-23(1958). CA 53-8502e

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CONTRIBUTION TO THE STUDY OF SOLANACEAE. THE BIOSYNTHESIS OF THE ALKALOIDS OF DATURA TATULA VAR. INERMIS. R. van Severen. *J. pharm. Belg.* 14, 36-44(1959). CA 53-17424a

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STUDY OF CHEMISTRY OF BIOLOGICAL OXIDATION IN PLANTS WITH APPLICATION OF OXYGEN-18. B. B. Vartapetyan. *Problemy Kinetiki i Kataliza, Akad. Nauk S.S.S.R., Inst. Fiz. Khim., Soveshchanie, Moscow*, 1956, 9, 124-8(1957). CA 53-8328f

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A HYGIENIC STUDY OF GRAIN IRRADIATED WITH RADIOACTIVE COBALT. E. N. Vasil'ev, L. A. Okuneva, and Iu. P. Kukel. *Vop. Pitan.* 19, (1961) Sept.-Oct.

940

EFFECTS OF RADIOPHOSPHORUS ON RYE PLANTS. Matilde Martinez Vazquez and Francisco M. Sarasola Sancho. *Bol. del inst. nacl. invest. agron. (Madrid)*, 20: No. 43, 287-309(Dec. 1960). (In Spanish)

The effects of P^{32} on rye plants have produced in their descendants (F_2) the following anomalies: minor vegetative development in the plant in all their stages, but major precocity; kernels not well appointed, but of interesting proteic value; ears very ramified, with more kernels than the normal rye, but with little fertility taking into consideration the big number of spikelets caused by their ramification; minor germinative faculty that the normal rye, very apparent in the country; a big inhibition in the development of the first lateral roots pairs; total inhibition in the development of the roots, belonging to the two lateral pairs placed nearest to the hypocotyl region; embryos with light of full torsion scutellum and coleoptyl can have origine for effect of the pressure suffered in the ovary since the space with which the fecundate ovules counts in the development will be reduced by the big density of the spikelets and so of flowers which show in the stalks secondary, tertiary etc. of the ramified ears; twin embryos with free, coleoptyls and embryos with double hypocotyl buds wrapped with one coleoptyl; big abnormality in the arrangement of the vascular system in the hypocotyl region of certain embryos, in order to determine it, in the scutellum vessels through coleoptyl, in embryos which show all their organs perfectly normal, without any deformation or torsion. These two anomalies lastly mentioned will be able to attribute to genetic causes; a big recuperation can be confirmed of the cells and almost the disappearance of the anomalies found in mitosis in plants with treatments; and in meiosis it has followed some citological alterations like the apparition of anafasic bridges, later chromosomes and supernumerarys, but in very little number.

941

UPTAKE AND TRANSLOCATION OF IRON 59 IN PHASEOLUS VULGARIS L. Leopoldo Villegas (Instituto Venezolano de Investigaciones Cientificas, Caracas). p.179-82 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

A study was made of the active uptake of iron at different stages of growth in black bean plants in relation to the rate of live weight increase. Weight increase and absorption values remained constant during vegetative growth and increased with maturation, with flower and fruit development. But the relationship between the two remained constant. This constant relationship suggests also a constant level of accumulation. The irreversibility of the process of active absorption was proved. A study was made of the retranslocation at different stages of growth, with affirmative results, although this process slows down as the plant matures.

942

ELECTRON TRANSPORT IN PHOTOSYNTHESIS. Wolf Vishniac (Yale Univ.). U.S. At. Energy Comm. BNL-512(C-28), 54-64(1958)(Pub. 1959). CA 53-20288g

943

THE INFLUENCE OF β -PARTICLES OF RADIOACTIVE ISOTOPES ON SIZE VARIATION IN CHLOROPLASTS OF ELODEA CANADENSIS. P. A. Vlassyuk and M. I. Bidzilya (Ukrainian Research Inst. of Plant Physiology). *Doklady Akad. Nauk S.S.S.R.* 119, 65-7(1958) Mar. 1. (In Russian)

Effects of β particles from S^{35} , Ca^{45} , W^{185} , and P^{32} on the size changes of chloroplasts in *Elodea canadensis* cells were studied. There are indications that small doses of β particles increase the *Elodea* chloroplasts.

944

LYSINE BIOSYNTHESIS IN CHLORELLA AND EUGLENA: PHYLOGENETIC SIGNIFICANCE. Henry J. Vogel (Rutgers Univ., New Brunswick, N.J.). *Biochim. et Biophys. Acta* 34, 282-3(1959)(in English). CA 53-19038f

945

ABSORPTION OF CARBON DIOXIDE BY PLANT-ROOTS. V. L. Voznesenskii. (V. L. Komarov Botan. Inst., Acad. Sci. U.S.S.R., Leningrad). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 5, 329-36(1958). CA-52: 20443g.

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PHYSIOLOGICAL STUDIES ON ACID METABOLISM IN GREEN PLANTS. VI. TRANSAMINASES IN CELL-FREE EXTRACTS FROM KALANCHOE LEAVES. D. A. Walker and S. L. Ranson. (King's Coll., Newcastle-upon-Tyne, Engl.). *Plant Physiol.* 32, 226-30(1958). CA-52: 14773h.

947

PHOSPHORUS AND BICARBONATE EFFECTS ON Sr^{85} ACCUMULATION BY BUSH BEANS. Arthur Wallace (Univ. of California, Los Angeles). *Soil Sci. Soc. Am. Proc.* 24, 327-8(1960) July-Aug.

Several exploratory studies were made of possible phosphorus and bicarbonate effects on the accumulation of Sr^{85} by bush beans. Without added bicarbonate, increasing

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the phosphorus increased the content of Sr^{90} in roots but had little effect on that in the tops. With a 10^{-2}M bicarbonate level, increasing the phosphorus resulted in a progressive decrease of Sr^{85} in both roots and tops. In the absence of phosphorus from the nutrient solution, the content of Sr^{85} in the roots increased markedly with the concentration of bicarbonate.

948

INFLUENCE OF PETROLEUM OIL ON THE TRANSLOCATION OF PHOSPHORUS IN SMALL LEMON PLANTS. Randolph T. Wedding and Louis A. Riehl. (Univ. of California, Riverside). *Am. J. Botany* 45, 138-42(1958). CA-52: 12108c.

949

SIMPLE METHOD FOR DETERMINING STRONTIUM-90 IN PLANT MATERIAL. E. Welte and U. Marckwordt (Landwirtschaftliche, Forschungsanstalt Buntehof, Hanover). *Atompraxis* 6, 228-9(1960) June. (In German)
A method for quantitative determination of Sr^{90} in plant material is described. In the course of analysis the substance was charred and the ash dissolved. Phosphate ions and hydroxides were separated from the solution. The alkaline earths were removed in the form of carbonates. From the radiochemical equilibrium between strontium and yttrium, yttrium was isolated and measured. No inactive strontium carrier was added. The calcium content of the sample served as a carrier for the strontium. The chemical yield was determined by adding Sr^{89} .

950

SENESCENCE OF ROSES. II. DARK FIXATION OF CARBON DIOXIDE BY CUT BETTER TIMES ROSES AT DIFFERENT STAGES OF SENESCENCE. Leonard H. Weinstein and Henry J. Laurencot, Jr. *Contribs. Boyce Thompson Inst.* 19, 327-40 (1958). CA-52: 20444h.

951

CONCENTRATION OF CESIUM-137 BY ALGAE. Louis G. Williams and H. D. Swanson. (Furman Univ., Greenville, S. C.). *Science* 127, 187-8(1958). CA-52: 12102g.

952

THE UPTAKE AND DISTRIBUTION OF RADIOACTIVE PHOSPHORUS (P^{32}) IN RELATION TO THE MUTATION RATE IN PLANTS. Watkin Williams and G. J. Dowrick. (John Innes Horticultural Inst., Bayfordbury, Engl.). *J. Hort. Sci.* 33, 80-95 (1958). CA-52: 13878e.

953

ASSIMILATION OF UREA ABSORBED THROUGH PLANT LEAVES. EXPERIMENTS USING UREA- N^{15} . Michihiko Yatazawa (Univ. Nagoya). *Nippon Dojo Hiriyogaku Zasshi* 28, 489-92(1958). CA 53-19263d

954

SEVERAL EXPERIMENTS UTILIZING RADIO-ISOTOPES. Yong-gyu Yi. Chosŏn Kwahakwon T'ongbo, No. 2, 21-2(Apr. 1959).

Test results are given for the phosphorus isotope metabolism balance and irradiation effects on seeds. A phosphorus-base fertilizer proved to be effective for corn, soybeans, and wheat. The proper time for applying phosphorus fertilizer to young plants is when the plants start to develop. The absorption of phosphorus is more active in the young cell of the plant than the old cell. In the soybean plant, the phosphorus observed in the day time returned to the soil during the night. Properly γ -irradiated corn increased its production by 10%. Similar results were obtained with γ -irradiated turnip seeds, and turnip seeds washed in an isotope solution.

955

MALONATE AS A PARTICIPANT IN ORGANIC ACID METABOLISM IN BUSH BEAN LEAVES. R. H. Young and L. M. Shannon (Univ. of California, Los Angeles). *Plant Physiol.* 34, 149-52(1959). CA 53-11545b

956

AEC-tr-3432
USE OF RADIOACTIVE CARBON C^{14} IN THE STUDY OF PHOTOSYNTHESIS. (Metody primeneniya radio-aktivnogo ugleroda C^{14} dlya izucheniya fotosinteza). O. V. Zalenskii, O. A. Semikhatova, and V. L. Voznesenskii. Translated from a publication of the Academy of Sciences, S.S.S.R., Moscow (1955). 111p. \$1.50(OTS).

A comprehensive study is reported of applications of carbon-14 in the study of the physiology of photosynthesis. Apparatuses used in the studies are described and illustrated. Carbon-14 was used in investigations of photosynthesis under both laboratory and natural conditions. Investigations were made of both the rate of photosynthesis and the composition of photosynthetic products following the fixation of carbon. 115 references.

957

INVESTIGATION OF FORMATION AND CONVERSION OF CATECHINS IN TEA-LEAVES USING C^{14}O_2 . M. N. Zaprometov and A. L. Kursanov. (K. A. Timiryazev Inst. Plant Physiol., Acad. Nauk Sci. U.S.S.R., Moscow). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 2, 310-19 (1958). CA-52: 20443e

958

THE SITE OF THE FORMATION OF CATECHINS IN THE TEA PLANT. M. N. Zaprometov. (K. A. Timiryazev Inst. Plant Physiol., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 2, 51-61(1958). CA-52: 10298b.

959

THE EFFECTS ON THE YIELD OF BARLEY GROWN FROM BARLEY GRAIN TREATED WITH SOLUTIONS OF BORON, MANGANESE, COPPER AND RADIUM. N. G. Zhezheh and N. P. Vard'ya. *Zapiski Leningrad. Sel'skokhoz. Inst.* 1956, 11, 217-20. CA-52: 20426f.

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Lafayette, Purdue University

IOWA

Ames, Iowa State University

KANSAS

Manhattan, Kansas State University

KENTUCKY

Lexington, University of Kentucky

Louisville, University of Louisville

LOUISIANA

Baton Rouge, Louisiana State University

New Orleans, Tulane University

MARYLAND

Baltimore, Johns Hopkins University

College Park, University of Maryland

MASSACHUSETTS

Cambridge, Harvard University

Cambridge, Massachusetts Institute of Technology

MICHIGAN

Ann Arbor, University of Michigan

Detroit, Public Library

East Lansing, Michigan State University

MINNESOTA

Minneapolis, University of Minnesota

MISSISSIPPI

State College, Mississippi State University

MISSOURI

Kansas City, Linda Hall Library

Rolla, University of Missouri School of

Mines and Metallurgy

St. Louis, Washington University

MONTANA

Bozeman, Montana State College

NEVADA

Las Vegas, Nevada Southern University

Reno, University of Nevada

NEW JERSEY

Princeton, Princeton University

Teaneck, Fairleigh Dickinson University

NEW MEXICO

Albuquerque, University of New Mexico

NEW YORK

Albany, The University of the State of

New York

Buffalo, State University of

New York at Buffalo

Ithaca, Cornell University

New York, Atomic Industrial Forum, Inc.

New York, Columbia University

New York, New York University

Rochester, University of Rochester

Schenectady, Union College

Syracuse, Syracuse University

Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA

Charlotte, Public Library of Charlotte

and Mecklenburg County

Durham, Duke University

Raleigh, North Carolina State College

NORTH DAKOTA

Grand Forks, University of North Dakota

OHIO

Cincinnati, University of Cincinnati

Cleveland, Public Library

Columbus, Ohio State University

Toledo, University of Toledo

Youngstown, Youngstown University

OKLAHOMA

Norman, University of Oklahoma

Stillwater, Oklahoma State University

OREGON

Corvallis, Oregon State University

Portland, Reed College

PENNSYLVANIA

Philadelphia, University of Pennsylvania

Pittsburgh, Carnegie Library

University Park, Pennsylvania State

University

PUERTO RICO

Rio Piedras, University of Puerto Rico

RHODE ISLAND

Providence, Brown University

SOUTH CAROLINA

Columbia, University of South Carolina

TENNESSEE

Knoxville, University of Tennessee

Memphis, Public Library

Nashville, Joint University Libraries

Oak Ridge, Oak Ridge Associated Universities

TEXAS

Austin, University of Texas

College Station, Texas A & M University

Dallas, Southern Methodist University

Houston, Rice University

Lubbock, Texas Technological College

San Antonio, Public Library

UTAH

Salt Lake City, University of Utah

VIRGINIA

Blacksburg, Virginia Polytechnic Institute

Charlottesville, University of Virginia

Norfolk, Old Dominion College

WASHINGTON

Pullman, Washington State University

Seattle, University of Washington

WEST VIRGINIA

Morgantown, West Virginia University

WISCONSIN

Madison, University of Wisconsin

Milwaukee, Public Library

WYOMING

Laramie, University of Wyoming