UR-268

718481

QUARTERLY TECHNICAL REPORT

April 1 thru June 30, 1953

THE UNIVERSITY OF ROCHESTER
ATOMIC ENERGY PROJECT
ROCHESTER, NEW YORK

UR-268

Health and Biology

THE UNIVERSITY OF ROCHESTER
Atomic Energy Project
P. O. Box 287, Station 3
Rochester 20, New York

Contract W-7401-eng-49

QUARTERLY TECHNICAL REPORT

April 1 thru June 30, 1953

It should be noted that the Quarterly Technical Reports of The University of Rochester Atomic Energy Project do not attempt to describe progress in all of the research programs but only in those in which some significant results have been achieved but which are not sufficiently complete to be written up as final reports.

Submitted by: Henry A. Blair
Director

Date of Report: 9/2/53

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SELECTED STUDIES ON THE ROLE OF BONE PHOSPHATASE IN CALCIFICATION

by
Victor DiStefano

ABSTRACT

As part of the general study of the problem of calcification, special attention has been given the role of phosphatase which was first ascribed a major role by Robison. A number of experiments have been performed with the aim of defining more precisely the specific part in the calcification process played by phosphatase.

* * * *

Because the Robison theory of calcification is based on a non-existent solubility product for the bone salt, this theory is not tenable. Robison's work, however, is of lasting importance because he drew attention to the possible part phosphatase may play in calcification.

The physiological role of phosphatase in calcification seems to be at least twofold: (a) it may contribute in some way to the formation of the bone matrix and (b) it protects the calcification process from the inhibitory effect of ester phosphate.

Attempts to explain why ester phosphate exerts a beneficial effect on calcification have not been fruitful in giving a new theory of calcification but considerable clarification of the problem has been achieved. It has been shown: (a) That ester phosphate does not contribute to the respiration of rachitic cartilage. It is not likely that phosphate esters maintain the calcifying mechanism by an effect on respiration. (b) That ester phosphate does not diffuse through a cellophane membrane at a faster rate than inorganic phosphate. The difference in the effects noted with ester phosphate and inorganic phosphate on calcification in vitro is probably not due to differences in the rate of diffusion of the two substances. (c) That phosphatase does not act as a transphosphorylase between

the bone matrix and glycerophosphate. This means that glycerophosphate does not contribute phosphate for the transphosphorylation of the hypothetical collagen fiber template. (d) That bone phosphatase does not remove phosphate ions from the site of calcification. Reasons are given why this experiment is not of a critical nature. New approaches to this problem are under investigation at the time of this writing. This hypothesis is the most attractive and if proven would elucidate the mechanism whereby ester phosphate aids calcification.

It has also been demonstrated that glycerophosphate is hydrolyzed comparatively rapidly by phosphatase. This sheds some light on the reason that glycolytic inhibitors do not affect calcification in vitro when glycerophosphate is the source of phosphorus but are powerful inhibitors of calcification when biological esters are used. Further exploration has shown that glycolytic inhibitors are effective in inhibiting calcification because of interference with cellular metabolism. It is suggested that a preformed surface, upon which mineral deposition takes place, deteriorates in the absence of cellular activity. Degeneration of the surface or template distorts the spatial arrangement of the phosphate groups thereon. This inhibits the formation of the bone salt lattice.

ATP is not beneficial to calcification of rachitic cartilage from the rat in vitro because (a) it is not attacked by the bone enzyme and only slightly by enzymes present in the slice and (b) it forms only slightly dissociated complexes with calcium ion.

A STATISTICAL EVALUATION OF CERTAIN FACTORS INVOLVED IN THE PLATING OF POLONIUM[1]

by
Frank A. Smith and Rocco Della Rosa

ABSTRACT

Factorially designed experiments have been completed in which the influence of a number of factors involved in the spontaneous plating of polonium from acid solutions were measured. From the results obtained, plating conditions were found such that the standard deviation of a single determination is five per cent of the activity present.

* * * *

The experiments to be described were undertaken in order to furnish a reliable estimate of the influence of a number of conditions operative in the spontaneous plating of polonium from acid solutions.

The first experiment was designed to measure the effects on plating efficiency of temperature, time, volume of solution, stirring, acidity, and evaporation. Each of the six factors was tested at two levels in a factorially designed experiment. The quantity of polonium was kept constant and was equivalent to 4000 counts per minute in each sample. The factors and levels tested are listed in Table 1.

A total of 32 platings were done. All foils were counted in scintillation counters in such a manner that the counting error did not exceed $\pm$ 2.5 per cent. The influence of each factor on plating efficiency was assessed by a statistical analysis of the counts obtained.

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[1]The factorial experiments required were designed and analyzed by Drs. S. Lee Crump and A.M. Dutton of the Statistics Division. We are pleased to acknowledge our indebtedness for their assistance and cooperation.

TABLE 1.

Factors Studied Factorially for Their Influence on the Spontaneous Plating of Polonium from Acid Solutions

Factor	Values
Temperature of plating bath	45°C and 90°C
Time of plating	45 min. and 90 min.
Volume of plated solution	50 ml and 100 ml
Stirring	as slow and as fast as practicable
Acidity of plated solution	0.5N and 0.25N HCl
Evaporation of plated solution	vol. replenished frequently and not replenished[1]

[1]When not replenished, approximately half of the volume was lost by evaporation.

The data resulting indicated that the rate of stirring, and loss of volume by evaporation did not affect significantly the quantity of polonium plated on the foil. Efficiency of the plating process was improved at the higher plating temperature, longer plating times, and in the larger volume of plating solution. The efficiency also was somewhat greater in the less acid solutions, though the improvement was quite small. It was concluded that the effects of time, temperature, initial volume, and evaporation need not be investigated further. The effects of lesser acidity of the plating solution, and of stirring appeared to warrant further study. Should stirring prove unnecessary, the design of the plating apparatus obviously would be much simplified.

Accordingly, a second factorial experiment was prepared to study further the effects of these factors. Three concentrations of acid were used, namely 0.1, 0.33 and 0.75N. Stirring was done at as rapid a rate as practicable, or eliminated entirely. The level of activity of polonium was 200 counts per minute. The experiment was repeated again, using 20,000 counts, and a third time at a level of 200,000 counts per minute. A total of 72 platings were made.

The results obtained indicated again that somewhat better plating resulted at the lower normality of acid. The improvement was slight, however. Stirring of the solution definitely is required since in stirred solutions the quantity of polonium spontaneously plated was approximately two times greater than was obtained in unstirred samples.

Using the 105 observations made, the standard deviation was calculated to be five per cent of the activity present for the range 200 - 200,000 counts per minute. The standard deviation varied directly with the amount of activity present.

A detailed report of these experiments, prepared in collaboration with the Statistics Division, will be issued later.

THE EFFECT OF A SOFT DIET ON RADIATION ILLNESS IN THE DOG

by
Molly P. Coulter

ABSTRACT

A soft diet fed to dogs before and after an LD/50 exposure to x-ray was ineffective in reducing the degree or extent of gastro-intestinal hemorrhage.

* * * * *

It has been suggested that a soft, low residue diet may alleviate the gastro-intestinal hemorrhage of acute radiation sickness. A diet suggested by Dr. W. B. Mason, of this Project, composed of Gerber's cereal food, evaporated milk, non-nutritive cellulose fiber and Abbott's vitamin B elixir with crude liver was used. Ten dogs received this diet for one month prior to radiation and during the post-radiation period. A control group of 10 dogs received Purina dog chow kibbled meal. The dogs received 450 r of 250 KV x-irradiation (LD/50). Six of the dogs on the soft diet and 3 of the control dogs died. At necropsy, one of the control dogs showed no gastro-intestinal bleeding. All of the other dogs that died showed mild to moderate small and large bowel hemorrhage.

At this dose of radiation, this soft, low residue diet had no effect on diminishing the degree or extent of gastro-intestinal hemorrhage.

EFFECTS OF A MINIMAL LETHAL X-RAY EXPOSURE ON SENSITIZATION OF MICE TO HISTAMINE

by
William K. Cotton and Robert W. Miller

ABSTRACT

From the results obtained, an exposure to x-irradiation resulting in a mortality of between an LD/10-LD/15 apparently does not sensitize mice to histamine in dosage levels of either 50 mgm./kg. or 1000 mgm./kg. given between the 5th and 20th day post-irradiation.

* * * *

It has been shown by various workers that injections of sub-lethal doses of H. Pertussis vaccine into mice sensitizes these animals to relatively small amounts of histamine (1, 2, 3).

Kind (2) suggests that the vaccine injected may produce adrenal cortical damage and thus interrupt the normal mechanism of response to stress.

Parfentjev and Goodline (3) were able to demonstrate that 5 days after injection of H. Pertussis vaccine, 2 mg. of histamine diphosphate was as toxic to the sensitized mice as 50 mg. was to normal animals.

To date, the effects of ionizing irradiation upon the adrenal cortex is poorly understood. Apparently, the adrenals are relatively radio-resistant. Brayer, Glasser and Duffy (4) have shown a temporary elevation in the excretion of adrenal steroids following x-ray exposure in pigs. Little is known,however, concerning the production of adrenal steroids following irradiation.

This experiment was devised to determine the effects of a maximal LD/0 exposure of x-irradiation on the sensitization of mice to injections of histamine.

Materials:

1. Mice - 210 female, all purpose, Albino mice from the Rockland Farms, weighing between 18-20 gms.

2. Histamine diphosphate - sterile 1% and 10% solutions.

3. X-ray factors - 350 r whole body x-irradiation from a 250 KV Picker Industrial X-ray unit. Rate 6.5 r/min., 43" TSD, 15 MA Filter: Alum. parabolic 1/2 mm. Cu.

Methods:

Ten mice were injected with 1000 mg./kg. of histamine diphosphate I.P. and served as the histamine control group. Forty mice received 350 r of whole body x-irradiation and served as radiation controls. One hundred and sixty mice were irradiated as above and in addition received injections of histamine as follows: eighty out of the one hundred and sixty in groups of twenty mice each, were injected with 1000 mg./kg. of histamine diphosphate on the 5th, 10th, 15th and 20th days post-irradiation. The other eighty mice, in groups of twenty, received 50 mg./kg. of histamine diphosphate on the same schedule. All of the animals used in this experiment were grouped by random selection.

Results:

It was expected that the above dosage of x-ray would result in an LD/0 mortality and therefore death of the animals following injection with histamine could serve as an index of sensitization following a sub-lethal exposure to ionizing irradiation. However, the mortality in the group was 29/200; 19 of these animals having died without receiving histamine; therefore, the mortality from x-ray becomes an LD/10-15.

The 10 animals which did succumb after histamine injections, died between 1-15 days after receiving their injections. It would be expected that if the deaths were due to sensitization to histamine, they would have occurred within 24-48 hours after the administration of the histamine.

Conclusions:

From the results obtained, an exposure to x-irradiation resulting in a mortality of between an LD/10-LD/15 apparently does not sensitize mice to histamine in dosage levels of either 50 mgm./kg. or 1000 mgm./kg. given between the 5th and 20th day post-irradiation.

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2. Kind, L. S.: The Altered Reactivity of Mice Following Immunization with H. Pertussis Vaccine, J. Imm., 70:411, 1953

3. Parfentjev, F. A. and Goodline, M.A.: J. Pharmacol. and Exper. Therap. 92:411, 1948.

4. Brayer, F. T., Glasser, S., and Duffy, B. J., Jr.: Effect of X-irradiation on Adrenal Steroid Excretion in Pigs, University of Rochester Atomic Energy Project Quart. Tech. Report, UR-260 p. 12, 1953.

Abstract of Paper Presented at
the 37th Annual Federation Meetings
Chicago, Illinois, April 6-10, 1953

PHOSPHATASES OF THE CELL-SURFACE OF INTESTINAL CELLS

by
A. Rothstein, R. Meier and T. Scharff

There was little or no direct absorption of glucose-1-phosphate from the intestine of the rat. However, the sugar phosphate and various other phosphate compounds were rapidly hydrolyzed in intestinal loops. One of the products, orthophosphate, could be almost completely recovered in the lumenal contents. The second product, glucose, was only partially recovered because of absorption of this substance from the intestinal lumen. The rate of hydrolysis of glucose-1-phosphate was about the same in all parts of the small intestine and also was the same in excised loops as in "in vivo" loops. In contrast the absorption of glucose was variable along the length of the intestine, and was markedly reduced in excised loops.

When glucose-1-phosphate with P^{32} incorporated was hydrolyzed, there was no equilibration of labeled phosphate with the phosphate of the intestinal cells, indicating that the hydrolysis was not taking place in the interior of the cells. Nor was any phosphatase secreted into the lumen under the conditions of these experiments. Therefore it is concluded that the phosphatases concerned are bound on the surfaces of the intestinal cells.

Abstract of Paper Presented at the Thirty-Seventh Annual Meeting
of the Federation of American Societies for Experimental Biology
Chicago, April 6-10, 1953

AGE INCREASE IN FLUORIDE CONTENT IN HUMAN BONE

by
Frank A. Smith, Dwight E. Gardner and Harold C. Hodge

It has been well established that fluoride retained in the animal body is deposited almost entirely in the skeletal system. A few analyses have been made on human bone. However, the much smaller number of samples analyzed indicate the need for a more solidly substantiated basis for the normal bone fluoride concentration, in order to offer a reliable base line (1) for future metabolic experiments; (2) for studies of the fluoride detoxication mechanisms; (3) investigations into the maximal amount of bone fluoride compatible with normal skeletal function; and (4) the determination of excessive exposure to industrial fluorides, or fluoride ingestion, e.g. fluoridated water. In this report the authors present the results of the analysis for fluoride concentration of samples of rib and vertebra from 85 males and 73 females, all long-term residents of Rochester. It was found that the bone fluoride concentration increased directly with increasing age, and was slightly greater for females than for males. Also, in both sexes the vertebra was found to contain slightly more fluoride than the rib. Comparison of the results obtained for these samples with those reported by other workers indicates that the maximal normal concentrations found are only about one-tenth of those found in persons working a number of years in fluoride-containing atmospheres.

If all fluoride in drinking water containing 1 ppm F were to be deposited in the skeleton, the situation still would be perfectly safe.

Abstract of Paper Presented at the Sixth Annual Summer Symposium
of the ACS Division of Analytical Chemistry
Troy, New York, June 19-20, 1953

ANALYTICAL CHEMISTRY OF MICRO-QUANTITIES OF BERYLLIUM

by
Taft Y. Toribara and Ruth E. Sherman

Because of the very toxic nature of beryllium, sub-microgram quantities of the element are of biological importance. Colorimetric, fluorimetric and spectrographic methods used to determine small quantities of beryllium are subject to interferences by other elements, necessitating a separation scheme to isolate the element before measurement. The fluorimetric method based on the interaction of beryllium with purified morin is the most sensitive chemical determination and compares favorably in sensitivity with the spectrographic method.

The separation of beryllium from bone proved to be most difficult because of the large quantity of calcium phosphate. Using a combination of steps consisting of precipitation, electrolysis with a mercury cathode, absorption on an ion exchange resin, and complexing with acetylacetone, it was possible to isolate completely the smallest measurable quantity of beryllium from all biological samples. The radioisotope Be^7 was employed in the determination of the efficiency of each step of the separation scheme.

Abstract of Paper Presented at
the Analytical Information Meeting
Oak Ridge, Tennessee, May 19-21,1953

DETERMINATION OF CALCIUM IN BIOLOGICAL MATERIAL BY FLAME PHOTOMETRY

by
Philip S. Chen, Jr. and Taft Y. Toribara

Calcium determinations in biological material by flame photometry at 620 mμ are convenient, rapid, and reliable. Phosphate suppresses the calcium emission, and protein partially prevents the action of phosphate. Studies have been made to determine when correction must be made for phosphate inhibition. Procedures have been developed for the determination of calcium in blood serum, serum ultrafiltrate, and urine.

Abstract of Paper Presented at
the 37th Annual Federation Meetings
Chicago, Illinois, April 6-10, 1953

THE INHIBITION OF GLUCOSE UPTAKE AND OF RESPIRATION OF DIAPHRAM MUSCLE BY MERCURY

by
D. J. Demis

In excised rat diaphram, a qualitative difference exists between the inhibitory effects of mercury on oxygen consumption and on glucose utilization. Respiration is hardly affected by 5×10^{-4} M mercuric chloride in 30 minutes but shows about 20% inhibition after one hour and 90% inhibition at the end of three hours. In contrast, essentially 100% inhibition of aerobic glucose uptake is produced by the same concentration of mercury within the first 15 minutes. A correlation has been made between the inhibition of respiration and the presence of mercury in the interior of the muscle cell, using a histochemical technique. With the same technique, no demonstration of mercury inside the cells could be made after 15 minutes exposure when maximal inhibition of glucose uptake prevails. It is suggested that the mercury-sensitive reactions involved in glucose uptake are located peripherally where they can be rapidly inactivated by mercury. On the other hand, the mercury-sensitive reactions in respiration are located in the interior of the cells, with the marked time lag in the inhibition of respiration associated with the slow inward diffusion of mercury.

Abstract of Paper Presented at
the 37th Annual Federation Meetings
Chicago, Illinois, April 6-10, 1953

HEMIN SYNTHESIS IN POLONIUM-INDUCED ANEMIA IN THE RAT

by
Robert G. Thomas, Kurt I. Altman, J. Newell Stannard and Kurt Salomon

The incorporation of α-C^{14}-glycine into circulating erythrocytes has been studied in rats made anemic by administration of the α-emitter polonium. Relative rates of C^{14} incorporation into hemin (measured as protoporphyrin dimethyl ester) and globin fractions remained unchanged despite the presence of moderate to severe anemia at the time of sacrifice. A significant lowering of the millimolar isotope concentration in hemoglobin and of the percent total C^{14} dose incorporated occurred in 4 groups of rats receiving 40 µc/kg of polonium. No significant lowering of the incorporation occurred in two other groups at this dosage level and in two groups at a lower dosage level. The lack of change in the C^{14} activity ratio of globin to hemin contrasts with earlier results obtained with x-rays in which marked alteration of this ratio were found. It cannot be stated whether this difference is due to the type of radiations involved or to the fact that the x-ray exposure was short while the radiation from polonium within the body is continuous.

Abstract of Paper Presented at
the 37th Annual Federation Meetings
Chicago, Illinois, April 6-10, 1953

METABOLISM OF ADRENAL CORTICAL HORMONES IN THE ISOLATED PERFUSED RAT LIVER

By
Leonard R. Axelrod and Leon L. Miller

Using the isolated perfused rat liver (Miller, L. L. et al. J. Exp. Med., 94: 431, 1951) and the analytical techniques of Zaffaroni (Science 111: 1950; J. Biol. Chem. 188: 1951) and Axelrod (Federation Proc. 11: 1952; J. Biol. Chem. in press) it has been found that the normal liver can effect the following reactions during the perfusion of cortisone, hydrocortisone and desoxycorticosterone: a) reduction with the introduction of C_{11} hydroxyl and oxidation with the introduction of C_{17} hydroxyl groups in the steroid molecule; b) oxidation of the $C_{20,21}$ side-chain to a C_{17} keto steroid with a C_{11} keto and/or C_{11} hydroxyl group; c) reduction of the Δ^4-α-β unsaturated ketone to 3(α) and 3(β) hydroxyl groups; d) reduction of the C_{11} keto group in cortisone to the C_{11} hydroxyl group of hydrocortisone. This reaction is apparently not reversible in the liver since perfusion of hydrocortisone does not yield detectable amounts of cortisone. Each compound isolated from the liver, bile, and perfused blood was identified by means of chromatographic positions; by mixed chromatograms with authentic compounds; by reaction of functional groups with a variety of reagents in spot tests; by formation of the acetate when possible and its chromatography; by ultraviolet absorption spectra of each compound in methanol; and by spectra of the sulfuric acid chromogen of the free compound and its acetate.

Abstract of Paper Presented at the 37th Annual Federation Meetings,
Chicago, Illinois, April 6-10, 1953

CHEMOPATHOLOGY OF HEMOGLOBIN SYNTHESIS IN MICE WITH HEREDITARY ANEMIA

By
Kurt I. Altman, Elizabeth R. Russell, Kurt Salomon, and James K. Scott

Hemoglobin synthesis was studied in a strain of mice in which hematopoiesis is interfered with by the W mutation resulting in a moderately or severely anemic genotype. In order to determine whether the normal rate of hemin and globin synthesis is altered in these anemic animals, hemoglobin synthesis was studied with the use of α-C^{14}-glycine over a period of time ranging from 48 hours to 40 days after injection of the isotope. Mice, 2 to 4 months of age, were injected i.p. with 2 μc of α-C^{14}-glycine per 100 gm body weight. The animals were sacrificed at varying time intervals and blood from 3-4 animals of identical genotype was pooled. Hemoglobin was isolated from the red blood cells and globin and protoporphyrin dimethyl ester were then prepared. The moderately anemic animals behaved like the normal animals with respect to the rate of hemin and globin synthesis. In the severely anemic animals, however, the slope of the C^{14}-activity-time curve of protoporphyrin is less steep than that of the moderately anemic and normal mice. In the severely anemic animals there is a definite lag period extending over the first 3 days after isotope administration during which the circulating protoporphyrin of hemoglobin contains no measurable C^{14}-activity. Inasmuch as globin synthesis in the severely anemic mice appears to proceed at essentially normal rates, it is suggested that one of the biochemical lesions resulting from the W mutation is localized in the chain of events leading to the synthesis of protoporphyrin from glycine.

Abstract of Paper Presented at
the 37th Annual Federation Meetings
Chicago, Illinois, April 6-10, 1953

INTERMEDIARY METABOLISM OF DL-LYSINE-ϵ-C^{14}

By
Morton Rothstein

DL-lysine-ϵ-C^{14} was administered to phlorizinized rats by stomach tube, or by food admixture. Urinary glucose was isolated and contained 1 to 3% of the fed C^{14} (based on L-lysine) with approximately 75% of the glucose-C^{14} being present in carbon atoms 3 and 4. This differs from the isotope distribution found in glucose derived from glutaric acid-1,5-C^{14}, indicating that pathways of lysine metabolism exist other than through glutarate. Lysine-ϵ-C^{14} is degraded in part to a 2-carbon fragment with a radioactivity on the order of that of the isolated glucose. Urinary ketone bodies are also significantly radioactive. There appears to be no significant conversion to glycine as indicated by hippuric acid isolation. Forty per cent of the L-lysine-ϵ-C^{14} activity was expired as $C^{14}O_2$ within 8 hours, the maximum rate being attained after 4 hours.

Abstract of Paper Presented at
the 44th Annual Meeting
The American Association for Cancer Research, Inc.
Chicago, Illinois, April 9-11, 1953

AN HEPATIC FACTOR ESSENTIAL FOR MAXIMAL SYNTHESIS OF PROTEIN BY THE WALKER TUMOR IN THE RAT

By
Leon L. Miller, James A. Fancher, and William F. Bale

When intact adult, male Wistar strain rats bearing a Walker tumor are given a dose of DL-lysine-E-C^{14} and sacrificed 6 hours later, 12-20 per cent of the L-lysine carbon-14 is found in the proteins of the tumor. Corresponding tumor-bearing rats completely eviscerated by the technic of Ingle, and given a similar dose of DL-lysine-E-C^{14}, incorporate only 1-5 per cent of the L-lysine C^{14} into the tumor proteins. The normal tissues of these rats incorporate 2-5 times as much C^{14} into their proteins as the tissues of the intact rats.

Control tumor-bearing rats, eviscerated except for the liver, which is left supplied by the hepatic artery, incorporate as much lysine-E-C^{14} into tumor proteins as is found in the tumor proteins of the intact rats.

Maximum Permissible Amounts of Radioisotopes in the Human Body and Maximum Permissible Concentrations in Air and Water. National Bureau of Standards Handbood 52. Superintendent of Documents, Washington 25, D. C. 1953. iv + 45 pp. 13 x 19.5 cm. Price, 20 cents.

Reviewed by H. A. Blair

The National Committee on Radiation Protection sponsored by the National Bureau of Standards is made up of representatives from organizations which are concerned with the safe use of ionizing radiation and radioactive materials. These organizations include several Medical societies, the U. S. Armed Forces, interested Government agencies and the National Electrical Manufacturers Association. It is the responsibility of this National Committee to make health and safety recommendations.

This particular Handbook prepared by the Subcommittee on Permissible Internal Dose under the chairmanship of Karl Z. Morgan, presents recommendations for maximal permissible levels of human exposure to those radioisotopes of greatest current interest which may gain entrance to the body by absorption, inhalation or ingestion.

The levels recommended are based largely on the principal of avoiding greater radiation than the equivalent of 0.3 roentgens per week to any organ other than the skin. Because such radiation produces no easily detectible biological effects this principal is commonly regarded as conservative, particularly for periods of exposure which do not extend over many years. However, there are still so many uncertainties with respect to the absorption, retention and distribution of inhaled or ingested radioactive materials in man, as well as with respect to the equivalent effectiveness of the particulate radiations in producing chronic injury that current estimates of permissible exposure levels to many radioisotopes cannot be made with that accuracy which would finally be desirable. Nevertheless, these recommendations, carefully considered by a competent

group of experts, provide a guide for health protection which is not likely to err in the direction of permitting dangerous over-exposure, particularly if the suggested factor of safety is adopted. The associated problem of whether the levels recommended can be economically achieved in industry is not discussed.

The source of the biological data for each case is given in the bibliography to facilitate review of the basis of any recommendation.

TECHNICAL REPORTS ISSUED FOR DISTRIBUTION

April 1, 1953 thru June 30, 1953

Report No.	Title	Authors	Subject Category
UR-217	Studies on Flash Burns: The Relation of the Time and Intensity of Applied Thermal Energy to the Severity of Burns (UNCLASSIFIED) Issued: June 9, 1953	Perkins Pearse Kingsley	Health and Biology
UR-229	The Acute Inhalation Toxicity of Carnotite Ore Dust; A Thirty-Day Study (UNCLASSIFIED) Issued: June 9, 1953	Wilson Stokinger Sylvester	Health and Biology
UR-234	The Probability Theory of Geiger-Müller Counters (UNCLASSIFIED) Issued: May 19, 1953	Jespersen	Instru.
UR-235	Modified Procedure for Analysis of Polonium^{210} in Biological Materials (UNCLASSIFIED) Issued: June 16, 1953	Scott Stannard	Health and Biology
UR-236	The Stability of Complexes between Calcium and Orthophosphate, Polymeric Phosphate, and Phytate (UNCLASSIFIED) Issued: April 8, 1953	Gosselin Coghlan	Health and Biology
UR-237	The Relationship of the Cell Surface to Metabolism. IX. The Digestion of Phosphorylated Compounds by Enzymes Located on the Surface of the Intestinal Cell (UNCLASSIFIED) Issued: April 8, 1953	Rothstein Meier Scharff	Health and Biology
UR-239	Comparison of Pathologic Effects of Radiation in Weanling and Adult Rats (UNCLASSIFIED) Issued: April 8, 1953	Casarett	Health and Biology
UR-240	Obstructive Pulmonary Emphysema and Bronchial Obstruction by Lymphatic Tissue in Ageing Rats (UNCLASSIFIED) Issued: May 26, 1953	Casarett	Health and Biology

Report No.	Title	Authors	Subject Category
UR-241	X-ray Depth Dose Measurements in a Phantom Dog (UNCLASSIFIED) Issued: May 26, 1953	Roberts Dahl	Health and Biology
UR-242	Quarterly Technical Report October 1, 1952 thru December 31, 1952 (UNCLASSIFIED) Issued: April 8, 1953		Health and Biology
UR-243	Differentiation as a Determinant of the Reaction of Rat Embryos to X-irradiation (UNCLASSIFIED) Issued: May 26, 1953	Wilson Jordan Brent	Health and Biology
UR-246	Physico-chemical Studies of Beryllium Complexes. V. The State of Beryllium in Blood (UNCLASSIFIED) Issued: June 9, 1953	Feldman Havill Neuman	Health and Biology
UR-247	Determination of Calcium in Biological Material by Flame Photometry (UNCLASSIFIED) Issued: June 16, 1953	Chen Toribara	Health and Biology
UR-248	A New Synthesis of DL-lysine-6-C^{14} and DL-α-Aminoadipic Acid-6-C^{14} (UNCLASSIFIED) Issued: June 16, 1953	Rothstein Claus	Health and Biology
UR-255	The Radium Content of Common Foods (UNCLASSIFIED) Issued: June 16, 1953	Shandley	Health and Biology
UR-256	The Quantitative Separation of Estrogens by Paper Partition Chromatograph (UNCLASSIFIED) Issued: June 30, 1953	Axelrod	Health and Biology
UR-257	The Radium Content of Public Water Supplies (UNCLASSIFIED) Issued: June 30, 1953	Hursh	Health and Biology
UR-260	Quarterly Technical Report January 1, 1953 thru March 31, 1953 (UNCLASSIFIED) Issued: June 30, 1953		Health and Biology