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FROM: M. E. Getzendaner

## MINUTES OF MEETING OF BIOLOGY DIVISION MEMBERS CONCERNING P-10 PROBLEMS - JULY 18, 1950

Present:

| | | | |
|---|---|---|---|
| LK Bustad | - Zoology | J Katz | - Biochemistry |
| CW Delong | - Biochemistry | PR McMurray | - H.I. Operations |
| NL Dockum | - Physiology | E Newcomb | - Biology |
| RF Foster | - Aquatic Biology | J Rediske | - Botany |
| TW Galbraith | Clinical Lab. | CM Patterson | - H.I. Operations |
| ME Getzendaner | - Chairman | JW Porter | - Botany |
| KE Herde | - Zoology | AA Selders | - Botany |
| MH Joffe | - Physiology | RC Thorburn | - Analysis |

### INTRODUCTION

The purpose of this meeting was to inform members of the Biology Division of the status of P-10 problems, to exchange ideas on methods of attacking these problems, and to develop new problems.

The P-10 Hazards Control Committee has been set up for the purpose of coordinating the efforts of H.I. and Technical Divisions toward the solution of problems of hazards arising from the production of tritium. The difficulty of confining tritium to prevent its spread makes the problems of great significance. It is the concern of H.I. Biology to solve those such as the biological effects,

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evaluation of hazards, and mechanisms of entry of tritium into biological systems, especially the human body.

In the course of production, contamination has become fairly widespread in the production laboratories. Certain persons, especially glass-blowers have been found to have concentrations above MPC's at times.

RC Thorburn outlined briefly methods of P-10 production.

Instruments for detecting contamination have been developed. Air exhaust lines are monitored with Kanne chambers which are ionization chambers using a vibrating reed to measure current carried by ion pairs formed. Pete, consisting of an open-windowed probe with methane flowing through it connected to an ASP scaler, semiquantitatively detects surface contamination. It is virtually impossible to detect quantitatively the amount of tritium on a surface since the beta radiation is so weak that only tritium very near the surface can be detected. Quantities of oxide in the air can be measured by absorption on calcium chloride and assaying the water for tritium. This is done by allowing the water to react with calcium carbide to form acetylene which is delivered to an ionization chamber, the current being measured with a vibrating reed electrometer. This method is sensitive to about 2 μc/liter ordinarily, but can detect as little as 1 μc/liter with extreme care. Organic material such as tissues can be burned, the water collected and assayed by this method. The method is slow; with present facilities in the biology building seven samples per day can be run.

REVIEW OF ACTIVITIES OF BIOLOGY DIVISION ON P-10

CW DeLong: Rats have been exposed in the hoods of 108 B, burned, and the water assayed by the acetylene method. In the first series, rat #1 exposed through

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2 process runs accumulated 4 mc/liter body water, rat #2 exposed for 10 process runs accumulated 22 mc/liter. It is not known whether this was taken in as free product or oxide; all was measured as oxide. In the second series, two rats accumulated 3 mc/liter.

Two rats on the hood room floor, and two on office floors acquired 5 μc/liter in 43 days (equilibrium was probably reached earlier).

A rat kept in a dessicator containing $T_2$ gas with KOH to absorb water and carbon dioxide from the atmosphere fixed 600 μc/liter as tritium oxide in body fluids in 4-5 days. The carcass is being kept to be analyzed for tritium in hydrogen-containing body constituents.

At present, 30 rats are in 108 B accumulating tritium in their bodies. After 4-6 weeks exposure they will be used for determination of biological half-life. This has been determined as about 10 days for humans; it is hoped the ratio between rat and human half-life will give a means for extrapolation on other data. The rats will also be used to study equilibrium conditions when exchange between tritium and hydrogen in metabolic pools has taken place. It is expected that accumulation will be on the order of 600 μc/liter which should give no radiation damage. No blanks have been run on rat experiments to date because of the limited facilities for analysis.

## FUTURE PLANS

Porter: A project was submitted last Spring on P-10 uptake by plants to determine whether it is taken up and incorporated within the plants by photosynthesis or other mechanisms. The program is not completely planned. Several species including bacteria, algae and higher plants should be used in studies searching for enzyme systems oxidizing tritium. These systems will be fewer in number



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and less complex than systems involving the oxide. Studies also should include the metabolism of labeled compounds, e.g. incorporation of glycine into chlorophyll. The program should start within the next couple of months.

Katz: Biochemistry might have a good problem in carbohydrate metabolism such as a glycolysis study since water is known to add and subtract during the glycogen to carbon dioxide cycle.

Foster: Action of P-10 on purely aquatic forms could be studied with sealed aquaria containing organisms from algae to fish, allowing them to reach equilibrium. Metabolic differences in various organisms have been indicated by the studies of Calvin and Benson with $C^{14}O_2$.

Joffe: What is the status in regard to toxicity?

The maximum permissible concentration is 1 mc/standard man. MPC in air is $10^{-6}$ µc/cc for the oxide, $10^{-3}$ µc/cc for free tritium. The experiment with a rat reported above indicates biological oxidation of the free gas so that MPC based on the oxide is the safer working value. The detectable limit is about 7 times lower than tolerance.

Joffe: Toxicity studies should be set up.

Hordo: Plant and animal biological monitoring of the 100 B area should be conducted.

PERCUTANEOUS ABSORPTION

The principle protection in P-10 production is the use of fresh air masks by the workmen. Undoubtedly their skin is often exposed to both tritium and its oxide. It has been suggested that chester white pigs be used to determine the extent of percutaneous absorption. Their skin somewhat resembles human skin, particularly with respect to radiation damage. However, the similarity may not hold beyond this. Pigs apparently do not have sweat glands.

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~~It is planned to expose the skin of young pigs to tritium and tritium oxide~~ to determine the extent of percutaneous absorption. A suggestion was made that small chambers containing the active samples be sealed onto the skin. Activities up to 1 curie might be handled in this way, although the problem of introducing and removing the sample without losing it would have to be solved. Subcutaneous tissue and blood could be analyzed to determine absorption.

In view of the doubt as to the analogy of pig and human skins, other animals, perhaps monkeys, should be considered. The best animal, of course, would be the human. Preliminary low dose studies could be run to determine the degree of similarity between man and other experimental animals.

It was recommended that feasible doses for human beings be calculated and experiments be proposed on the basis of those calculations. In human studies, doses should start very low and work up to detectable amounts.

(Thorburn) Studies on dried blood and finger tissues from an accidentally contaminated workman were made. Analysis showed no fixed tritium in the organic constituents, within a day or so after the accident, although whole blood and urine showed contamination. The tissues analyzed are not very active metabolically; liver and other actively metabolizing tissues should be studied.

Attention of the group is called to: (1) "Preliminary report on human excretion of tritium" Document LAMS 1099. (Official Use Only)
(2) "Several Methods Used for Calculating MPC's" HA Kornberg, Document HW-17438. (Secret.)

M. E. Getzendaner
Biochemistry Group
Biology Division
HEALTH INSTRUMENT DIVISION

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