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## Radioisotope Distribution in Visceral Organs of White Mice<sup>1</sup>

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MCCLUGAGE<sup>4</sup>, AND STEVE LIVESSEY<sup>4</sup>.

*Abstract.* White mice, previously medicated over a three week period with reserpine, thyroxine, ascorbic acid and streptomycin were given 0.3 Microcurie or radioactive phosphorus<sup>32</sup> by intramuscular injection. After 24 hours the mice were sacrificed, ten organs removed, and the amount of radioactivity retained was recorded in counts per minute per gram.

Results showed males retained more of the isotope than females in all organs except gonads and brain. Liver, intestine, and kidney retained more of the isotope than other organs with each medication. With the reserpine medicated animals there was less radioactivity retained by ten organs. The control group had the next most, followed by ascorbic acid, and streptomycin-medicated animals. Greatest retention of the isotope was in the thyroxin-medicated groups.

In a series of papers (Shell et al., 1961, 1964), the authors have published the results of thyroxine and reserpine medication on various physiological activities of white mice. This study was concerned with retention of injected radioactive isotope of phosphorus 32 by ten specific body organs. The effects of accelerated metabolism produced by thyroxine medication and decelerated metabolism produced by the tranquilizer reserpine on retention of this isotope were noted. This study was also concerned with radiation protection by use of medicinals such as streptomycin, ascorbic acid (Vitamin C), and cysteine as recorded by Vogel and Jordan (1960, 1962) and by Storer et al. (1957).

### MATERIALS AND METHODS

White mice at age eight weeks were given 0.25 mg of reserpine daily for a three-week period, then injected with 0.3 uc of radioactive phosphorus 32 by intramuscular injection in the right hind leg. After 24 hours the mice were sacrificed, and ten organs were removed and homogenized in Ringers solution and sea sand in an ice bath. The homogenate was placed on planchets, dried, weighed, and the amounts of radioactivity retained after 24 hours were recorded in counts per minute per

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gram. Counting was done with a scaler rate of the RCL type for five minute periods. This gave results for the entire organ. Fifteen animals were used in each determination and average of results were taken.

Homogenates were centrifuged and separate determinations were made on filtrate or supernatant and upon residue for comparisons with the entire organ and to study distribution in the two portions. Determinations were made on brain, liver, kidney, gonad, lung, spleen, intestine, stomach, heart and left hind leg muscle. Sex and age differences were noted.

Mice given 0.03 grains thyroxine per day for a three-week period before injection with isotope were used. The amount of isotope and determinations were the same as described above for reserpine. Mice treated with ascorbic acid were given a dosage of 1.2 mg per day over the three-week medication period and determinations as described previously were run. A dosage of 0.01 mg streptomycin per day over the three-week period was all that could be tolerated by the animal before injection with the isotope.

RESULTS AND DISCUSSION.

Initial results indicated that the male retained more of the isotope than the female in all organs except the gonads in the

|           | <b>CONTROL</b> |        | <b>RESERPINE TREATED</b> |        |
|-----------|----------------|--------|--------------------------|--------|
|           | MALE           | FEMALE | MALE                     | FEMALE |
| BRAIN     | +              | -      | -                        | +      |
| STOMACH   | +              | -      | +                        | -      |
| INTESTINE | +              | -      | +                        | -      |
| LIVER     | +              | -      | +                        | -      |
| LUNG      | +              | -      | +                        | -      |
| KIDNEY    | +              | -      | +                        | -      |
| MUSCLE    | +              | -      | +                        | -      |
| SPLEEN    | +              | -      | +                        | -      |
| HEART     | +              | -      | +                        | -      |
| GONAD     | -              | +      | +                        | -      |

Table 1. Retention of radioactive isotope phosphorus in white mice by ten organs. Comparison of males and females, control and reserpine treated animals.

control group. In the reserpine-treated animals the male retained more of the isotope than the female in every organ except the brain. A reversal in amount of isotope retained by the gonads was noted with the reserpine-treated animals from the control group. These data are recorded in Table 1.

With control groups subjected to the isotope the gonads, liver and intestine retained the greatest amount of the isotope. With thyroxine, the liver, kidney and intestine had greatest retention in that order.

With reserpine and asorbic acid the order of retention by organs was intestine, liver, kidney; and liver, intestine, kidney, respectively. The intestine retained more of the isotope in the reserpine-treated animals than in the ascorbic acid group but kidney and liver retained less than with the acid. With streptomycin the order of retention by organs was intestine, liver, kidney. (See Table 2.)

RETENTION OF RADIOISOTOPES 24 HOURS AFTER INJECTION  
in counts per minute

| <u>ORGAN</u> | <u>CONTROL</u> | <u>THYROXINE</u> | <u>RESERPINE</u> | <u>VIT. C</u> | <u>STREPTOMYCIN</u> |
|--------------|----------------|------------------|------------------|---------------|---------------------|
| HEART        | 164            | 95               | 90               | 94            | 132                 |
| SPLEEN       | 174            | 110              | 92               | 95            | 126                 |
| BRAIN        | 169            | 67               | 64               | 156           | 110                 |
| STOMACH      | 170            | 150              | 124              | 166           | 171                 |
| INTESTINE    | 204            | 928              | 728              | 694           | 630                 |
| KIDNEY       | 177            | 1065             | 225              | 294           | 293                 |
| GONADS       | 310            | 100              | 89               | 91            | 130                 |
| ST. MUSCLE   | 174            | 163              | 87               | 124           | 220                 |
| LUNGS        | 144            | 79               | 92               | 197           | 160                 |
| LIVER        | 213            | 1074             | 568              | 714           | 412                 |

Table 2. Retention of radioisotope in ten organs in white mice control and medicated.

When the total amount of isotope retention for all ten organs was considered, the thyroid medication gave greatest retention and reserpine medication the least. The reserpine-medicated animals retained less of the isotope than did the controls. Results for ascorbic acid and for streptomycin were almost the same.

Comparing retention for ten organs in counts per minute per gram for 15 animals obtained were:

|           |      |              |      |
|-----------|------|--------------|------|
| Control   | 1899 | Vitamine C   | 2325 |
| Thyroxine | 3761 | Streptomycin | 2384 |
| Reserpine | 1502 |              |      |

In comparing filtrate or supernatant with residue in the centrifuged homogenates, we found in most instances the greatest retention of radiation in the residue rather than in the supernatant. This was true without variation in liver, kidney, and intestine and generally true with brain, spleen, and lung. In no instance did we find greater retention in muscle residue, but the supernatant had many times more retained radiation than the residue. Results are in Table 3.

| RETENTION OF RADIOISOTOPES 24 HOURS AFTER INJECTION<br>In counts per minute, Filtrate and Residue |          |        |           |        |         |        |              |        |
|---|----------|--------|-----------|--------|---------|--------|--------------|--------|
|   | THYROXIN |        | RESERPINE |        | VIT. C. |        | STREPTOMYCIN |        |
|   | Filt.    | Resid. | Filt.     | Resid. | Filt.   | Resid. | Filt.        | Resid. |
| HEART   | 44       | 54     | 45        | 45     | 49      | 45     | 66           | 68     |
| SPLEEN  | 60       | 50     | 42        | 50     | 45      | 46     | 55           | 71     |
| BRAIN   | 27       | 40     | 31        | 33     | 99      | 57     | 58           | 52     |
| STOMACH   | 60       | 90     | 41        | 83     | 71      | 95     | 72           | 99     |
| INTESTINE   | 85       | 843    | 152       | 630    | 75      | 619    | 197          | 427    |
| KIDNEY  | 81       | 984    | 58        | 167    | 64      | 230    | 134          | 136    |
| GONADS  | 47       | 53     | 35        | 54     | 39      | 52     | 62           | 70     |
| LEG MUSCLE  | 98       | 65     | 50        | 37     | 60      | 64     | 96           | 132    |
| LUNGS   | 36       | 43     | 41        | 51     | 98      | 99     | 52           | 69     |
| LIVER   | 234      | 840    | 69        | 499    | 204     | 511    | 97           | 314    |

Table 3. Retention of radioisotopes in white mice by ten organs, comparing filtrate and residue from homegenate.

Although considerable difficulty was encountered in injecting mice with streptomycin, we found, as expected, the greatest amount of radiation retention in the liver, with intestine and kidney following in that order. This differed from earlier results only in that the liver and intestine changed rank. Time could account for this.

The results obtained with streptomycin were encouraging because of the work of Vogel and Jordan (1960, 1962) Argonne National Laboratories, using the same medication as a protective agents against direct radiation, and the work of Storer et al (1957) and Thomson (1962) concernng radiation protection in mammals.

Further experimentation is needed using other isotopes and combinations of medication. Further work to determine any significant differences as to age of animals and varying dosages of the isotope would be helpful.

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## Effects of Estradiol Hormone on the Maturation of the Gonads and Associated Duct System of the Fish *Lebistes reticulatus*<sup>1</sup>

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*Abstract.* It was the purpose of this study to describe the secondary sex characters and the histological appearance of the gonads, including the associated duct system, of the fish *Lebistes reticulatus* from birth through differentiation and maturation when subjected to the hormone estradiol. Sixty-four *Lebistes reticulatus* were fed 0.125 mg of estradiol, beginning at birth, at intervals of 60 hours. An equal number of fish were used as the control. Fish were sacrificed at ten-day intervals following birth, for a period of 80 days, and examined for the presence of secondary sex characters. Serial cross sections of the gonads were prepared from 32 experimental fish and 16 control fish. Estradiol hormone, when fed to male *Lebistes reticulatus* suppressed the appearance of male secondary sex characters, but did not stimulate the appearance of female sex characters. Estradiol had no apparent effect on the secondary sex characters or gonads of females. The effects produced by estradiol feeding on the testes were: a stunted testicular size, a suppression of spermatogenesis, an accumulation of connective tissue stroma within the medulla of the organ, a suppression of secretory activity of cells lining the sperm ducts.

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