

## 7071 P

## Effect of Adrenalectomy on Salt Metabolism in Rats.

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The findings recorded were observed in studies to determine whether the adrenal glands regulated the metabolism of the body salts. White rats weighing between 150 and 180 gm. were used.

Salt balance studies were carried out on 4 pairs of animals before and after complete bilateral adrenalectomy. A control period of 5 to 6 days preceded the removal of the glands. Twenty-four hours after operation when the animals had completely recovered from the surgical shock, the study periods which varied from 6 to 11 days began.

The symptoms of adrenal insufficiency were: Loss of weight, decrease in food and water consumption, gradually progressing inactivity and weakness, and a diminution in the amount of urine and feces excreted. Death in the untreated animals occurred within 10 days after operation. Within 12 to 24 hours of death the respiratory rate increased, the body temperature fell, and there was a roughening of the fur with a rusty pigmentation of the hair about the head. Later, hemorrhages occurred about the nose and from the conjunctivae. Jumpiness and convulsions were noted terminally.

Balance studies were made for Ca, Mg, Na, K, P, Cl, and N. Our analyses show that during insufficiency there is not only a loss of sodium and chlorine as has been emphasized by other observers,<sup>1</sup> but a great loss of all elements studied—a negative balance for each of these occurred. The negative balance of N, P, K, Ca, and Mg, shows that tissue destruction has taken place.

Because of this loss from the body of these many basic elements following adrenalectomy, it occurred to us that in the treatment of adrenal insufficiency, one should aim at replacing all of those substances. To this end, after the animal was in marked insufficiency, a solution containing .0329% CaCl<sub>2</sub>, .015% MgCl, .7% NaCl, and .0350% KCl, was substituted for the distilled water used in the control periods.

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<sup>1</sup> Marine, D., and Baumann, E. F., *Am. J. Physiol.*, 1927, 81; Loeb, R. F., *Science*, 1932, 70, 420; Loeb, R. F., Atchley, D. W., Benedict, E. M., Leland, J., *J. Exp. Med.*, 1933, 57, 775; Harrop, George A., Weinstein, Albert, Soffer, L. J., Trescher, J. H., *J. Am. Med. Assn.*, 1933, 100, 1850; Harrop, George A., Soffer, L. J., Ellsworth, R., Trescher, J. H., *J. Exp. Med.*, 1933, 1, 58.

The improvement in the animals following this change was striking. Even if this fluid was not given until within 2 to 3 hours before the time that death would have ordinarily occurred, the animals could be restored to a normal state within 4 to 5 hours after its administration. We have so far kept completely adrenalectomized animals in apparent health for 4 months on this mixture. No evidence of edema has appeared in these animals.

During severe insufficiency the animals were so weak that the salt mixture had to be given by pipette. Studies in progress suggest that other anions and cations should be included in the mixture, and possibly an increase in the amount of those ions already included. We have begun a comparative study using normal salt solution (.9% NaCl) as a treatment fluid. While our results are not as yet conclusive, it is our impression that these animals have not done as well as those on the salt mixture.

We do not feel certain that the action of adrenal hormone is primarily one of salt regulation, although this is quite probable. Further studies of the effect of starvation on the salt balance might elucidate this point. Such studies are now in progress. Our observations show that completely adrenalectomized animals may be kept in apparent normal health for long periods if sufficient salts are given.

## 7072 C

### A New Form of Drop Recorder.

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Gibbs<sup>1</sup> classifies the drop recorders reported in the literature according to the essential mechanism as follows: (a) impulse, (b) weight, (c) expansion, (d) electrolytic, and (e) displacement. The simple and effective drop recorder here described depends upon a principle quite different from any described heretofore, and resulted because of our trial and abandonment of some of the most promising types, including that described by Gibbs.<sup>2</sup>

The essential part of our form of drop recorder consists of a short length of capillary tubing sealed to a bulb and T tube. A cur-

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<sup>1</sup> Gibbs, O. S., *J. Lab. Clin. Med.*, 1927, **12**, 686.

<sup>2</sup> Gibbs, O. S., *Science*, 1931, **74**, 549.