Missouri Section.

St. Louis University School of Medicine,
Wednesday, March 9, 1932.

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Are Seasonal Variations of Thyroid Gland Dependent Upon Corresponding Variations in Anterior Pituitary?*

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Seidell and Fenger[1] observed very striking seasonal fluctuations in the amount of iodine in the thyroid glands of hogs, sheep and beef, more being present and the gland being smaller during the summer than during the winter season. Fenger[2] confirmed these results. Martin[3] working with sheep glands arrived at similar conclusions. Loeb[4] in studying the compensatory hypertrophy of the thyroid gland of the guinea pig noted that this hypertrophy was considerably less in the summer than in the winter months.

We may then assume that during the colder periods of the year the thyroid gland is much more active, perhaps owing to the fact that more demands are made on this organ than during the warmer season. As a result of the lessened need for thyroid hormone during the summer months, iodine, instead of being used in the metabolism of the gland is stored up in the acini.

It has now been established that the functional state of the thyroid gland is to a marked extent influenced by a hormone of the anterior pituitary. Following previous observations of Allen,[5] Smith,[6] and

* These investigations were carried out with the aid of a grant for research in science made to Washington University by the Rockefeller Foundation.

1 Seidell, A., and Fenger, F., *J. Biol. Chem.*, 1912, **13**, 517.

2 Fenger, F., *Endocrin.*, 1918, **2**, 98.

3 Martin, N. H., *Pharm. J.*, 1912, **89**, 144.

4 Loeb, Leo, *J. Med. Res.*, 1920, **41**, No. 4.

5 Allen, B. M., *Anat. Rec.*, 1917, **11**, 486.

6 Smith, P. E., *Anat. Rec.*, 1917, **11**, 57.

Uhlenhuth and Schwartzbach[7] in amphibian larvae, Loeb and Bassett[8] observed that in mammals (guinea pigs) injections of extracts of the anterior pituitary cause a marked hypertrophy and hyperplasia of the acinus cells of the thyroid, a liquefaction and absorption of colloid, indications of an increased hormone action (loss of weight), therefore, in general, changes corresponding to those observed in Graves disease. To these changes corresponded a marked rise in basal metabolism under the influence of anterior pituitary extracts. (Siebert and Smith.[9])

Under these conditions it was conceivable that the seasonal variations in the thyroid gland were due to corresponding variations in the activity of the anterior pituitary. We wished, therefore, to determine whether such seasonal changes could be established in the activity of this gland.

For this purpose we collected separately anterior pituitary glands of cattle during the winter months (1930-31) and during June, July, August and September (1931). We obtained thus 5 different samples of anterior pituitary powder which were kept in the refrigerator and the strength of which was compared by us at the same time by preparing and injecting extracts into young female guinea pigs in the manner previously described by Loeb and Bassett.[10]

Intraperitoneal injections of 0.5 cc., 1 cc., and 2 cc., of the winter, and of the June, July, August and September extracts were given respectively to 2 groups; one being examined after 4 injections and the other group after 6 injections given on successive days. In addition, doses of 0.3 cc. were given for 4 days. The size of the thyroids thus obtained was then compared and this was followed by a microscopic examination of changes in size and shape of the acini, the amount and consistency of the colloid present in the acini, the height and size of the acinar epithelium, number of mitoses and the presence of phagocytes in the remnants of the colloid. In all cases, typical effects previously described were noted in these thyroid glands and no significant differences were found between the effectiveness of the various extracts.

We then compared the effects of the winter, June and August material on the basal metabolism of guinea pigs in the manner described by Siebert and Smith.[9] All these extracts were found ac-

[7] Uhlenhuth, E., and Schwartzbach, S., *Brit. J. Exp. Biol.*, 1927, **5**, 1.

[8] Loeb, Leo, and Bassett, R. B., PROC. SOC. EXP. BIOL. AND MED., 1929, **26**, 860.

[9] Siebert, W. J., and Smith, B., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 622.

[10] Loeb, Leo, and Bassett, R. B., PROC. SOC. EXP. BIOL. AND MED., 1930, **27**, 490.

tive; the August material happened to be the most active one, while the winter and June material were about of equal strength.

Conclusions. We may conclude that seasonal variations corresponding to those which have been observed in the mammalian thyroid gland could not be established in the case of the anterior pituitary of cattle. While these investigations do not absolutely exclude the possibility that cyclic changes of a more subtle kind may occur in this organ, they render them at least very improbable. It is, therefore, probable that the seasonal variations in the thyroid gland are not determined by primary changes of an annual cyclic character in the anterior pituitary, but that they are due to climatic differences during the seasons of the year, and that the effects of these differences are transmitted to the thyroid gland either directly from the periphery or indirectly through the mediation of other organs. The seasonal changes in the thyroid gland apparently correspond to differences in the need of thyroid hormone at different times of the year. Owing to a diminished need of thyroid hormone on the part of the organism during the summer months, after extirpation of the greater part of the thyroid the remaining part of the gland responds less actively with compensatory hypertrophy during this time of the year.

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Simple Method for Obtaining Antisera in a Dry State.

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Several reports deal with the preparation of dry antisera. Evaporation *in vacuo* and precipitation in the cold with alcohol or acetone are the methods most used. According to reports dealing with the latter method, the low temperature has been assumed to be the factor preventing denaturation and loss of antibody activity. We have found that the concentration of the organic precipitant is an equally important factor. There exists a critical concentration of the organic solvents methyl, ethyl and propyl alcohol and acetone, in the range of 60% to 75% concentration at which denaturation of serum proteins is maximal. As the concentration is increased from about 75% the degree of denaturation is decreased until at final concentrations of 90% or above serum proteins can be precipitated