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Three Dimension Graphs for Contrasting Various Endocrine Organs of Thymus Rats with "Age-Weight-Gland" Controls.

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By ordinary two-dimension graphs, relationship between age and body weight in rats is well illustrated as well as relationship between various organs and age or body weight. Only by three dimension graphs however is it possible to illustrate the interrelation of age and body weight and also the weight of any given organ.¹ Such graphs have been particularly helpful in evaluating the influence of thymus extract on the various endocrine organs of the rat, whose general

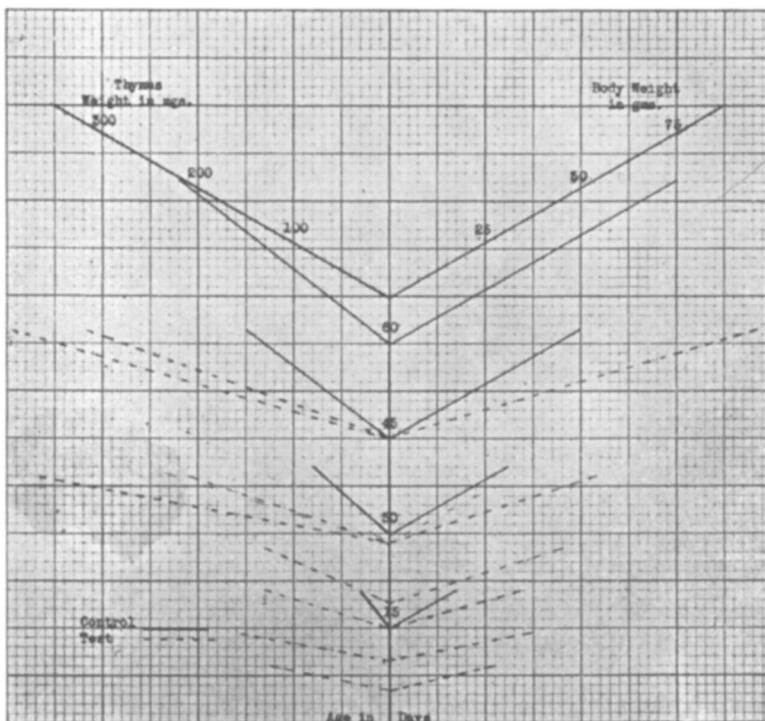


CHART 1.

Comparison of "age-body-thymus-weight" in thymus injected rats and controls. Note increase in both body-weight and thymus-weight in test strain. The larger thymus weights of rats at 15, 27 and 45 days of age are in females.

¹ Clark, J. H., PROC. SOC. EXP. BIOL. AND MED., 1936, **35**, 139.

body growth is so much more rapid than normal. Thus it affords comparison with age-weight controls, in contrast to controls of comparable age but lower body weight or comparable weight and greater age. Eight thymus-injected rats exhibiting average precocity are used to illustrate the usefulness of these graphs.

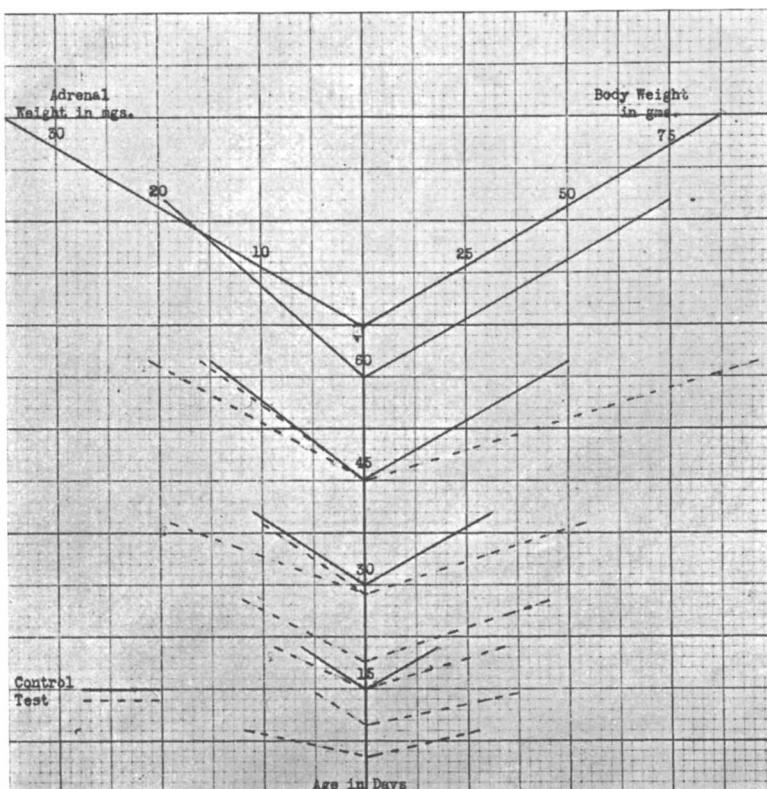


CHART 2.

Injections of thymus extract produce more marked deviation from normal in body-weight than adrenal-weight. Heavier adrenals at 15, 27 and 45 days of age are in females.

Thymus-treated rats appear grossly normal, differing mainly in their size with respect to age. Therefore the "age-weight" graph of the injected rats is not parallel to the normal (Chart 1), nor is the "age-gland-weight," since the thymus gland in thymus-treated rats is consistently heavier than normal. This increase in size is apparently due, on histologic examination, to the cortex being slightly wider than normal and less sharply demarcated from the medulla, both being crowded with lymphocytes. Hassall's cor-

puscles are less easily distinguished, seem fewer and are composed of fewer reticular cells than normal controls.

We gain the impression, through sacrificing rats and weighing the adrenals, that they tend to be below normal; plotted three dimensionally however (Chart 2) this does not seem to hold, nor was any deviation from normal observed histologically in the ordinary stains. (The graph for normal adrenals is the average between males and females for the plotted age-weight). The same observations apply to the thyroid.

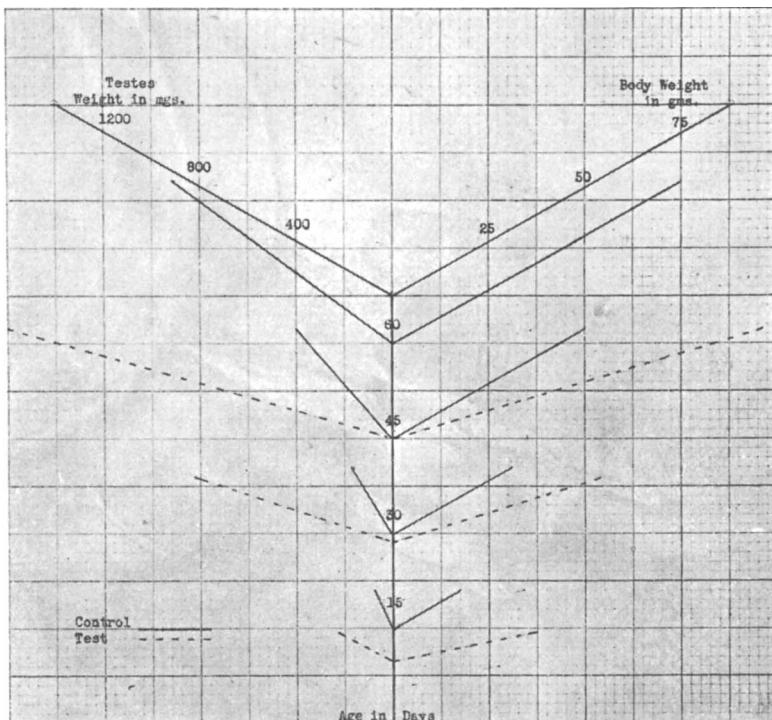


CHART 3.
Body-weight and testis-weight in thymus injected rats contrasted with normals.

The testes in treated rats descend into the scrotum at a much earlier age (2-3 days) than normal (31-40 days). They are much heavier than in control rats (Chart 3), due apparently to more rapid differentiation into the mature type of gland; lumina appear in the tubules of such testes about the 10th day and spermatids about the 25th (Fig. 1), contrasted with about the 30th and 40th days respectively in controls.

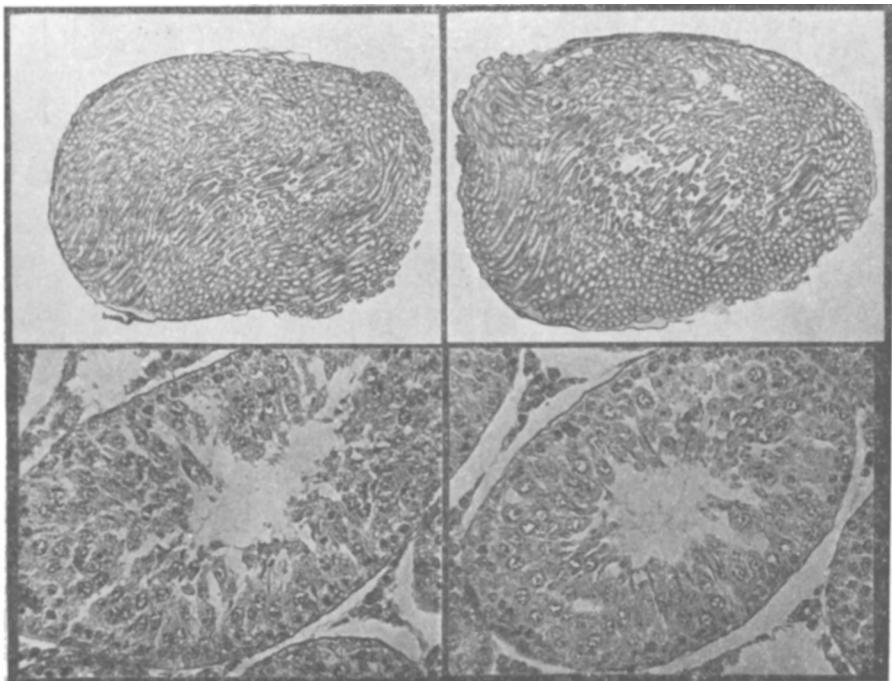


FIG. 1.

Low (x11) and high (x345) power photomicrographs of testes of 44-day-old control (upper and lower left) compared with a 25-day-old thymus injected rat (upper and lower right). Testis of thymus injected rat is larger and shows more spermatids than control.



FIG. 2.

Low power (x36) photomicrograph of ovaries of a 44-day-old control rat (left) contrasted with a 9-day-old thymus injected rat (right). Note definite corpora lutea in ovary on right.

Even greater precocity in sexual development and differentiation has been noted in female rats. Our records list the opening of the vagina on the 6th day (normal 55-62 days) and corpora lutea have been observed as early as the 9th (normal 62-64 days) (Fig. 2).

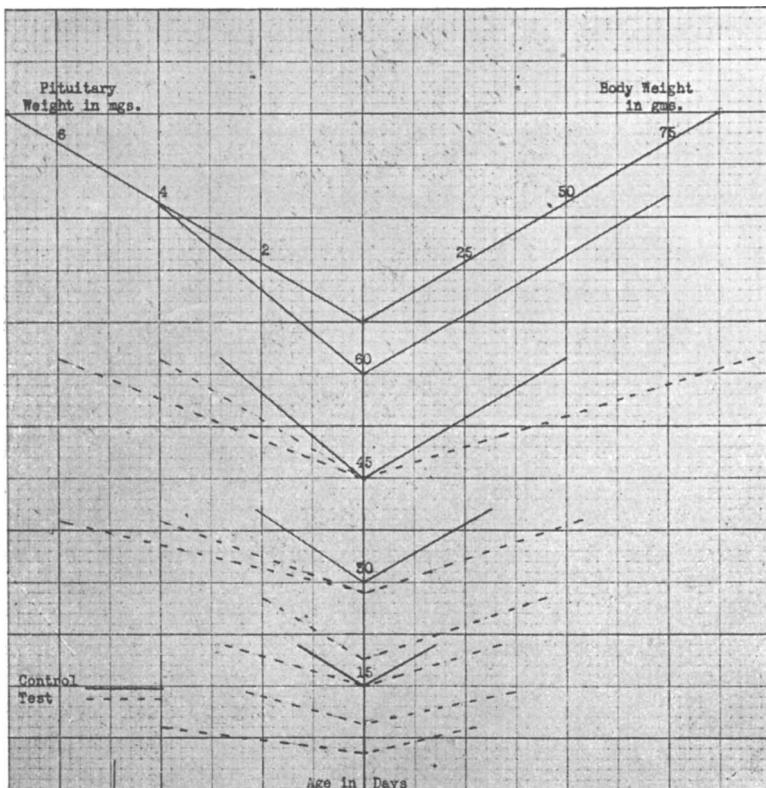


CHART 4.
Effect of thymus extract on weight of pituitary. Larger weights at 15, 27 and 45 days of age are in females.

Chart 4 shows the weight of the pituitaries of the test strain compared to those of their age-weight controls. These seem definitely in excess of normals, particularly in younger rats. In differential cell counts, the content of acidophils in the younger rats is greater than in age-weight-gland controls. This forms the subject of another report. A biometric study of certain endocrine organs of the rat is reported to demonstrate, by three-dimension graphs, the effect of thymus extract on them. This is supplemented by a brief note on the pertinent histologic deviations from normal.