The Effect of Transplantation of Additional Thyroid Tissue on the Basal Metabolic Rate of the Laboratory Rat

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The purpose of this experiment was to determine whether or not additional thyroid tissue, implanted into an otherwise normal rat, would be controlled in the same manner as in the normal pituitary-thyroid axis. If this be the case, then the metabolic rate probably would not fluctuate markedly subsequent to the addition of thyroid tissue. Should the metabolic rate then rise above normal, it would seem that the pituitary-thyroid transplant and the pituitary-original thyroid axis do not function in unison in maintaining a normal oxygen consumption rate in the rat. Since the metabolic rate is controlled by the thyroid is was assumed that this pituitary-thyroid control could be determined by measurement of oxygen comsumption.

The oxygen consumption of each of sixteen male test rats was determined previous to the transplantation using a modification of an apparatus designed by Grad (1). A complete thyroid of a donor was transplanted into the eyes of a litter mate test animal and following the transplantation the oxygen consumption (converted to basal metabolic rates) of each test animal was determined again.

Two persons were employed in performing the thyroid transplant operation. While the thyroid was being removed from a donor rat a co-worker prepared the test animal for the transplant. A small incision was made through the sclera or cornea of each eye at a lateral angle, into which a thyroid lobe was transplanted. In some cases the lobe had to be cut in half to facilitate its insertion into the eye chamber. Either the anterior or posterior chamber could have been used. The anterior chamber was used at the beginning of the problem but later, and more successfully, the posterior chamber was employed. Normally no sutures were needed to close the eye.

In addition to metabolic measurements, an attempt was made to assess the effect of the transplant on (1) the histology and weights of the pituiatary and the original thyroid, and (2) the gross anatomy of the gonads.

The results of the experiment showed no histologically observable influence of the transplants on the pituitary, the original thyroid, or the gonads. No significant differeneces were obtained when the weights and percent body weights of the pituitaries and normal thyroids of rats with follicular transplants were compared with rats with non-follicular transplants. The addition of thyroid tissue did appear to affect the basal metabolic rate of the rat. The metabolic rate was higher than normal the first and second days, and a reduction to below normal in oxygen consumption occurred between the third and fifteenth days following the operation.

A modification of the initial hypothesis was made following the experiment. The rise and fall of the oxygen consumption would indicate that the pituitary-thyroid axis does not respond as rapidly as first supposed. There is enough fluctuation in the metabolic rates following the transplantation to indicate that the pituitary-original thyroid and pituitary-transplant axis do operate in unison and, given time, would produce a normal oxygen consumption.

REFERENCE CITED

1. Grad, B. 1952. A simple method for the measurement of the oxygen consumption and heart rate of rats. Endocrinology, 50: 94-99.