

which had been treated by a single injection of nicotinic acid (50 mg intravenously) while the animal remained on the experimental diet.

The periods of hypermotility were interrupted in 3 of our 6 animals by other periods of hypomotility. Whether hyper- or hypomotility was present, however, the entire gastrointestinal tract was involved so that gastric emptying time, small bowel passage time, and propulsion in the large intestine were all affected. The large bowel appeared the least susceptible to the effects of the deficiency.

It is our impression that the P-P factor (nicotinic acid, nicotinamide, or any carboxypyridine derivative capable of replacing these in the diet) is essential to the maintenance of normal gastrointestinal motility, and that absence of this factor leads to motor dysfunction of the intestinal tract prior to the appearance of the usually accepted deficiency symptoms. We base this opinion on the response of many cases of functional digestive disturbance in the human, some of which have shown hypermotility, to nicotinic acid; and on the abnormal intestinal motility appearing in dogs on a black-tongue-producing diet long before mouth lesions were evident. Although we have not been able to demonstrate any effectiveness of thiamin or riboflavin in functional digestive disturbances, it is entirely possible that other factors in the vitamin B complex may be concerned with gastrointestinal function.

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### **Persistence of Medullary Tissue in Homotransplanted Adrenals.**

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Observations by the senior author<sup>1</sup> indicated that the anterior chamber of the eye was a favorable site for the incorporation and persistence of adrenal cortices in the rat. Out of 243 grafts persisting subsequent to insertion of whole glands, medullary tissue was observed in only one instance. Since it was possible to increase the incidence of medullary persistence by removal of the surrounding cortex previous to insertion into the eyes, it was postulated that the survival of medullary tissue was conditioned by the rapidity of vascularization or by the accessibility of nutritional substances. In

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<sup>1</sup> Turner, C. Donnell, *Anat. Rec.*, 1939, **73**, 145.

view of the current interest<sup>2-4</sup> in the viability of endocrine glands following disruption of their normal innervation, these studies on the adrenal medulla were pursued further by transplantations into the kidney.

Whole adrenal glands from newborn rabbits were transplanted bilaterally into the eyes of 6 adult female hosts. The grafts were frequently observed macroscopically through the corneas and were removed for histological examination after persistence for 60 days. Two grafts from one host were found highly fibrotic and no traces of adrenal tissue were detectable. All of the remaining grafts contained cortices (Fig. 1) and the disposition of the cortical cells approximated that characteristic of normal intact glands. Seven of 10 non-fibrotic grafts possessed medullary tissue (Fig. 1).

We find that whole adrenal glands from newborn mice incorporate and persist well when inserted underneath the kidney capsule of the mother. To this date 47 out of approximately 55 such grafts have been recovered after persistence for periods varying from 2 days to 4 months. Thirty-two transplants of this type (68%) have been found to possess variable amounts of medullary tissue (Fig. 2). In some cases the extent and histological character of the medullary tissue in the grafts did not differ appreciably from that present in intact glands from animals of comparable ages. In the adrenals of the mouse the medulla approaches the exterior in the region of the hilus, and we believe that this is a factor which facilitates rapid vascularization and hence medullary incorporation in this species. In our best instances of medullary persistence the hilus of the gland has been pressed against the substance of the kidney. So far none of the transplants have contained medulla when the glands were inserted with the hilus away from the kidney tissue, *i. e.*, pressed against the kidney capsule.

*Summary.* Seven out of 12 whole adrenal glands from newborn rabbits contained medullary tissue after being homoplastically transplanted into the anterior chambers of adult female hosts. Under the conditions herewith described, 68% of adrenal homotransplants into the kidney of the mouse contained medullary tissue for from 2 days to 4 months after transplantation. The observations are interpreted as indicating that the survival of the medullae in adrenal transplants is conditioned, in part, by opportunities for rapid vascularization or

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<sup>2</sup> Haterius, H. O., Schweizer, M., and Charipper, H. A., *Endocrinol.*, 1935, **19**, 673.

<sup>3</sup> Haterius, H. O., *Cold Spring Harbor Symposia on Quantitative Biology*, 1937, **5**, 280.

<sup>4</sup> Fisher, C., Ingram, W. R., and Ranson, S. W., *Monograph on Diabetes Insipidus*, 1938.

by the accessibility of nutritional body fluids. The functional capacity of the medullary tissue in our transplants has not been demonstrated.

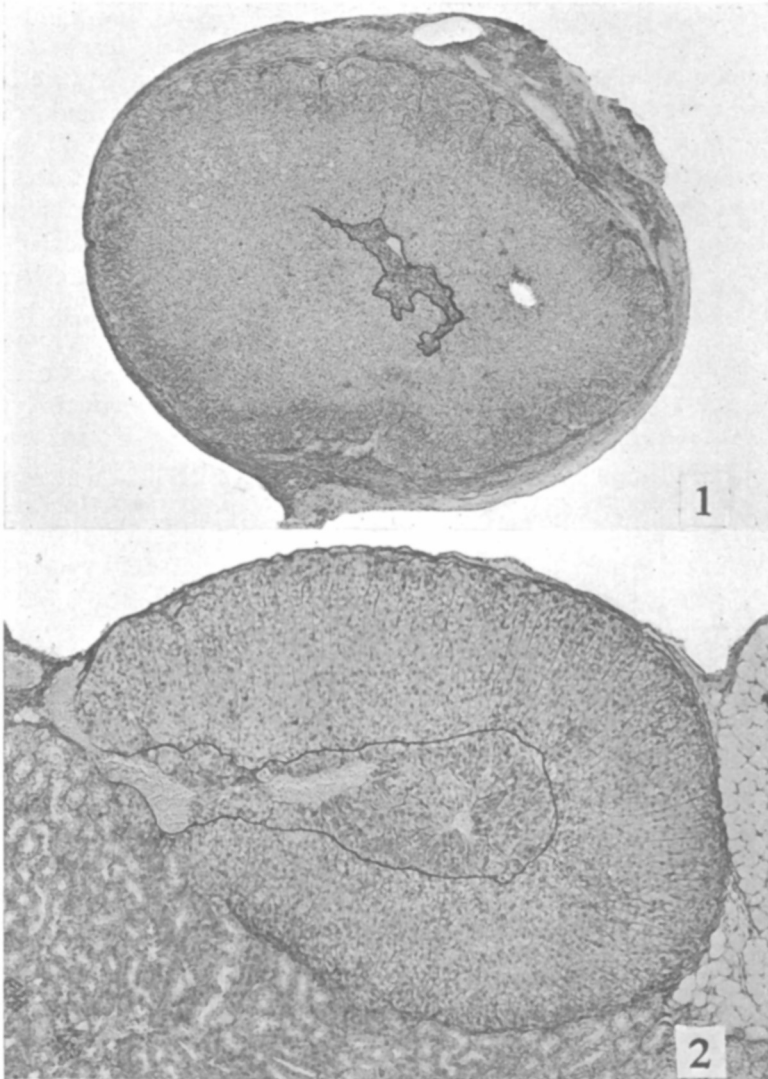


FIG. 1.

Adrenal gland from a newborn rabbit 60 days after homotransplantation in the anterior chamber of the eye of an adult female host. The cortico-medullary boundary has been outlined with ink.

FIG. 2.

An adrenal 3 months after homotransplantation in the kidney of an adult mouse. Note the persistence of the medulla and the position of the hilus with reference to the kidney substance. The cortico-medullary boundary has been outlined with ink.