

## Persistence of Taste Organs in Tongue Grafted to Liver. (23745)

MARGARET R. WRIGHT (Introduced by L. S. Stone)

*Department of Zoology, Vassar College\**

It has previously been recorded that taste organs of the adult newt (*Triturus v. viridescens*) can persist for at least a year without benefit of any trophic action from gustatory nerve fibers(1). This information was derived from histological examination of taste organs in tongue-tips grafted to orbit. The sense organs are effectively divorced from gustatory nerve connections in such grafts, but there is reason to believe that other nerve fibers of central origin grow into the tissues. For example, the striated muscle of the tongue does not atrophy. It was considered possible, therefore, that a trophic influence from invading, non-specific, nerve fibers could play a role in maintenance of structure of the taste organs deprived of specific nerve fibers. In order to denervate the grafts more completely, tongue-tips were transplanted to the liver. It seems most unlikely that there can be any innervation to the graft tongue tissues other than by autonomic fibers such as those associated with blood vessels. This is borne out to some degree by the fact that striated muscle atrophies in these grafts.

**Methods.** Autoplastic transplantations were performed on 111 newts as follows. With the animals under chlorotone anesthesia, a small incision was made in the ventro-lateral body wall just posterior to the axilla on the right side; the surface of the liver, well anterior to the incision, was scratched lightly to provide a suitable graft site; the tip of the tongue was excised, inserted through the incision, and released in the vicinity of the scratched liver; and, finally, the edges of the incision were pinched together. All animals were kept nearly motionless in cool moist-chambers until the incision had sufficiently healed to warrant their being placed in aquaria. Of the 57 transplants eventually recovered, 43 were attached only to the liver, 8 were connected

to both liver and body wall, and 6 remained free in the body cavity. Grafts were recovered at various time intervals after transplantation, but the primary object of the present account is to report only on the 11 cases examined histologically after 4 months.<sup>†</sup> All these grafts were well vascularized.

**Results.** The grafts range in size from one to 2.5 mm in diameter. The number of taste organs on the surface of the grafts ranges from none to 63, but there is no direct relation between the number of taste organs and the size of the graft. There are taste organs of normal structure in 8 of the 11 cases.

The meaningful correlation, apparently, is between the number of sense organs and the area of *normal* tongue epithelium, but the character of the surface epithelium is highly variable. Three of the grafts are covered by a flat, membranous epithelium. These have no taste organs though 2 of them are as large as another graft possessing 63 organs. The latter, however, is entirely covered by a normally thick epithelium. Another graft of comparable size has 19 organs, and its epithelium is partly of normal thickness and partly membranous. One smaller graft is primarily covered by a membranous epithelium, but it has a small patch of thick epithelium which supports three sense organs. The remaining five grafts contain combinations of the normal, the membranous, and a highly glandular and ciliated type of epithelium. The numbers of sense organs in these (15, 2, 7, 6, 9+) also vary according to the area of normal epithelium.

It is impossible to know in these experiments at what time after operation the grafts became attached to the liver. It seems a reasonable assumption that there was considerable variation in this respect. It, therefore, may follow that the epithelium in those

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cases taking a relatively longer time to establish vascular connections began to degenerate, and that the variation in the number of sense organs in these grafts is a reflection of that circumstance. The fact that all "grafts" which remained free in the body cavity were covered only by membranous epithelium containing no sense organs lends support to this interpretation.

At any rate, the experiment clearly indicates that taste organs can be maintained in the newt for at least 4 months without any trophic influence from nerve fibers of central origin in their immediate vicinity.

**Summary.** Tongue-tips were transplanted autoplastically to the liver in *Triturus v. viridescens* to effect denervation of the taste organs. All well-vascularized grafts that re-

tained a normally thick epithelium contained histologically normal taste organs when examined 4 months after transplantation. This fact indicates that these taste organs were independent of any trophic action from nerve fibers of central origin. The number of persistent taste organs is correlated with the amount of normal epithelium. It is suggested that differences in the time of reestablishment of circulation in the grafts may account for the variation found in the type of epithelium (thin, membranous or normal) and, therefore, may also account for the variation in number of taste organs persisting.

1. Mintz, B., Stone, L. S., *PROC. SOC. EXP. BIOL. AND MED.*, 1934, v31, 1080; Wright, M. R., *ibid.*, 1951, v76, 462; ———, *J. Exp. Zool.*, 1955, v129, 357.

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## Respiration of Rat Liver Homogenates Following Prolonged Cold Exposure. (23746)

JOHN P. HANNON (Introduced by Kaare Rodahl)

*Biochemistry Department, USAF Arctic Aeromedical Laboratory, Ladd Air Force Base, Alaska*

Although it has been fairly well established (1) that cold exposure leads to an increased tissue oxygen consumption, relatively little is known about the factors responsible for this increase. Work with tissue slices, as shown previously (2), is uninformative in this regard, since the rates observed are for the most part indicative only of endogenous respiration. The work that follows was undertaken in order to elucidate some of the factors responsible for the changes observed with slices. To this end, a variety of substrate oxidations were tested in control and in cold-exposed animals with a period of exposure which has been shown previously (2) to yield a maximal respiratory response in slices.

**Methods.** Male rats of the Sprague-Dawley strain were used in all experiments. They weighed between 225 g and 275 g at the time of selection. By the time of sacrifice for tissue studies, they were in the range of 275 to 350 g. The selection was made to obtain

groups of rats of similar initial weight, being subjected to cold exposure and acting as controls. The exposed animals were placed in individual cages in a cold room maintained at  $5 \pm 1^\circ\text{C}$ . for intervals of 29 to 33 days, whereas the controls were maintained in the animal colony at about  $26^\circ\text{C}$ . Both the control and experimental groups received a diet of "Friskies" dog food and water, given *ad libitum*, up to the time of sacrifice.

Tissue preparation consisted of a liver homogenate made up as follows: The animal was first killed by blow on head and the liver quickly excised and chilled in ice-cold 0.25 M sucrose. Utilizing a Potter-Elvehjem type homogenizer (3), a 10% homogenate was prepared from a portion of the large median lobe. This was carried out in ice-cold 0.25M sucrose containing 0.01M ethylenediamine-tetraacetic acid (pH 7.4). After filtering through 4 layers of cheesecloth to remove any large-size tissue fragments that may have been present, the homogenate was diluted to  $3\frac{1}{3}\%$  with