THE NATURE OF THE VILLI IN THE SMALL INTESTINE OF THE RAT

It is well known that adult rats have no true villi in the upper part of the small intestine but have instead a series of parallel ridge-like structures. This can best be appreciated by viewing the mucosal surface under low-power magnification with the dissecting microscope. It has been assumed that this is the normal pattern for the rat.

In a study of human small-intestinal biopsy material in apparently healthy South Indian adults, we were surprised to find no specimens with finger-like villi, though such were present in human foetuses. This finding led to a study of the villi in the rat at different ages. Litters of albino rats from a local in-bred strain were reared separately. Litter mates were sacrificed at different intervals after birth, and the villi along the whole length of the small intestine were studied under a dissecting microscope.

RESULTS

At birth finger-like villi are present throughout the small intestine, from the beginning of the duodenum to the end of the ileum (fig. 1). Within ten days of birth, while the animals are still living exclusively on breast milk, the villi in the upper jejunum are seen to be slightly leaf-like in shape; instead of being round in transverse section they are longer one way than the other, the longer diameter being always roughly at right angles to the long axis of the intestine. These leaf-like structures gradually become broader and broader as the animals grow older, until finally in the duodenum and upper jejunum of the adult the villi are represented by a series of parallel ridges.

Fig. 1—Duodenal mucosa of newborn rat viewed under a dissecting microscope. (×40.)

Fig. 2—Duodenal mucosa of 4-month-old litter mate of rat shown in fig. 1. (×40.)
(fig. 2). Distally, in the adult, the ridges are replaced first by broad leaves and then by narrower leaves, and in some cases in the lower ileum finger-like villi may still be present.

**DISCUSSION**

This change in villus architecture may in fact represent the "normal" physiological response to ageing, but if this is so there is no explanation of why the change is not uniformly distributed along the whole of the small intestine. In man in the West, similar alterations in villus architecture are seen only in pathological states, but the extent to which the results of observations in man can be applied to rats, is debatable.

The change is always maximal in the duodenum and upper jejunum, and it decreases in severity distally. A similarly altered villous architecture is present in tropical sprue, in "normal" Indian subjects, and in coeliac disease. This suggests that the change in the rat may be the end-result of damage caused by some toxic substance in the food or upper intestinal secretions. Further work on this subject is in progress.

**ADDENDUM**

Since submitting this preliminary communication we have seen the paper of van Lennep describing the intestinal mucosa of the long-nosed bandicoot which has finger-like villi in the newborn and ridges in the adult.

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