The turnover and shedding of epithelial cells

Part II  The shedding in the small intestine

SYNOPSIS  The loss of epithelial cells from the tips of villi is a visible phenomenon in the opened small intestine of the dog.

In a previous paper we have confirmed that the epithelial lining of the gastro-intestinal tract is in a state of continuous replacement. Arising by division in the crypts and basal areas of the glands the cells migrate to the surface where they disappear, it is presumed by shedding into the lumen. Leblond and Stevens (1948) have described 'streamers' of cells built up on the tips of the small intestinal villi and postulate that these are zones of extrusion where the cells are cast off into the lumen. They suggest that the villous activity assists the cells in their escape. We have been impressed by the observation that such shedding can only rarely be found in histological sections of the small intestine. Almost all the villi are covered with a continuous sheath of epithelial cells, and streamers or breaches of continuity at the tips are the exception. In autoradiographs, using tritiated thymidine as a nuclear label, shed cells were only rarely found in the lumen of the gut.

The present observations were made upon the small intestine of dogs under anaesthesia to ascertain whether shedding of cells was a visible phenomenon.

METHODS

The observations were made on 30 dogs under nembutal anaesthesia in the course of a series of experiments on villous activity. The small intestine was delivered through a median incision and opened down the antimesenteric border. The gut wall was pinned down on cork and the mucosa irrigated with Locke's solution at 38°C. The villi were observed through a Leitz dissecting microscope.

RESULTS

The villi have a regular contour (Fig. 1), though under the highest power (× 100) the outline is seen to be slightly granular. In almost every animal at some stage of the experiment an appearance was
seen which seemed to indicate shedding of cells. The tips of the villi appeared ragged in outline and small clear masses could be seen to detach themselves from these irregular areas (Fig. 2). These were retrieved by a micropipette and proved to be clumps of epithelial cells. This phenomenon was decidedly patchy but was observed from duodenum to ileum. There was no relation between shedding and villous activity or the length of time between the observation and opening of the gut. The appearance was present irrespective of whether the dog was fasted or fed before the experiment.

In a few animals another appearance was seen. Areas were found where most of the villous tips were capped by a white substance. Sections of these areas showed that the white caps were epithelial cells piled up into a heap several cells deep. Active shedding was not seen in these areas.

Where the mucosa had been exposed for some time or had been irrigated with Locke’s solution that was warmer than usual (40°C to 45°C) an opaque cloud was seen to form. This was tenacious and stringy and clearly was mainly formed of mucus. The opaque mucus was aspirated and fixed on a slide and stained. It contained vast numbers of ‘sheaths’ of epithelial cells which were complete epithelial casts of villi. These must have desquamated from almost the whole length of the villi. They contained no substance of the core of the villi.

**DISCUSSION**

The shedding of small intestinal cells into the lumen of the dog’s intestine is clearly visible but the mechanism is not clear. It is not related to villous activity and, indeed, the turnover of cells in the stomach and colon, where there is no activity comparable to the villous contractions, is as fast as in the small intestine. Shedding also appears to be an intermittent phenomenon.

The reason for the prodigious turnover of cells is difficult to understand. The replacement for loss from wear and tear is an obvious explanation but the appearance of spontaneous shedding suggests that the proliferation is in excess of this need. A second explanation could be that cell shedding is, in some way, related to the function of secretion of mucus and mucus may be actively secreted by the process of cells shedding. In support of this are the observations of marked mucus secretion associated with massive cellular desquamation, although of course, the experimental conditions under which it was seen make one hesitate before assuming that it happens in the intact animal.

**SUMMARY**

In the dog it is possible to see the shedding of clumps of epithelial cells from the tips of the villi. Occasionally caps of heaped up epithelial cells are visible on the tips of the villi.

Abnormal conditions provoke an excessive outpouring of mucus and this is associated with massive desquamation of the epithelial covering of the villi.

We wish to thank Professor R. C. Curran for much help and encouragement in these experiments and Mr. A. E. Clark and Mr. R. G. Lack for technical assistance.

**REFERENCES**


