

## Serotonin Producing Cells in the Small Intestine of Newborn Rats – Light Microscopic and Immunohistochemical Study

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Investigating the role of the serotonin-producing EC cells in the differentiation of the small intestine of rats we study the early neonatal period. At this stage the intestinal wall is not morphologically matured. The aim of the current study is to determine the presence and localization of the enterochromaffin EC cells in the mucosa of the small intestine of rats in the early neonatal period. Material and methods: Specimen of the small intestine of 1-day-old newborn rats is studied immunohistochemically for expression of serotonin.

The expression of serotonin in a small number of cells regularly spread along the small intestine is confirmed. The differentiated EC cells are located predominantly in the covering epithelium of the villi situated individually among the rest of the epithelium cells.

*Key words:* serotonin, small intestine, enterochromaffin cells.

### Introduction

Serotonin is one of the important neurotransmitters and signal molecules in the gastrointestinal tract [1]. Through different types of specific receptors in the smooth muscle cells, secretory cells, neural fibers it takes part in the regulation of the gastrointestinal motility, secretion and sensitivity [2]. Serotonin is produced by enterochromaffin cells that can be found in all parts of the gastrointestinal tract but their highest concentration is in its proximal sections – stomach, duodenum, jejunum.

Our immunohistochemical study of the differentiation of the enterochromaffin EC cells in the small intestine of rats focuses on the early neonatal period because in this period the intestinal wall is still morphologically immature.

The aim of the study is to determine the presence of differentiated enterochromaffin EC cells through immunohistochemical expression of their serotonin as well as their localization in the mucosa of the small intestine of rats in the early neonatal period.

## Materials and Methods

The study is carried out on fragments of the small intestine of 10 one-day-old rats. The material for the immunohistochemical study of serotonin is fixed in Buen's solution for 24 hours. Paraffin slides are investigated by the ABC method with primary antibody for MAB352 serotonin (rabbit polyclonal antibody – Chemicon USA) dilution 1:200 at 4°C for 12 hours. Serotonin is visualized as brown colored granules.

## Results

The routine study of the paraffin slides coloured with H-E staining shows that morphogenetic processes in the small intestine of the one-day-old rats are not yet complete. The intestinal villi of the newborn are high and parallel to each other. They have a thin basal part and a widening central part. The covering epithelium is columnar and single-layer. In between the villi there is a small number of shallow crypts of Lieberkuhn. The muscular coat is composed of spindle shaped smooth muscle cells arranged in thick layers in different directions (Fig. 1).

The immunohistochemical study showed presence of differentiated EC cells through the expression of the serotonin they contain. The reaction is positive in a small number of cells. They are situated in the covering epithelium of the intestinal villi (Figs. 2, 3). The cells are cone-shaped. The expression of serotonin is localized in the wide basal part of the cell (Fig. 4).

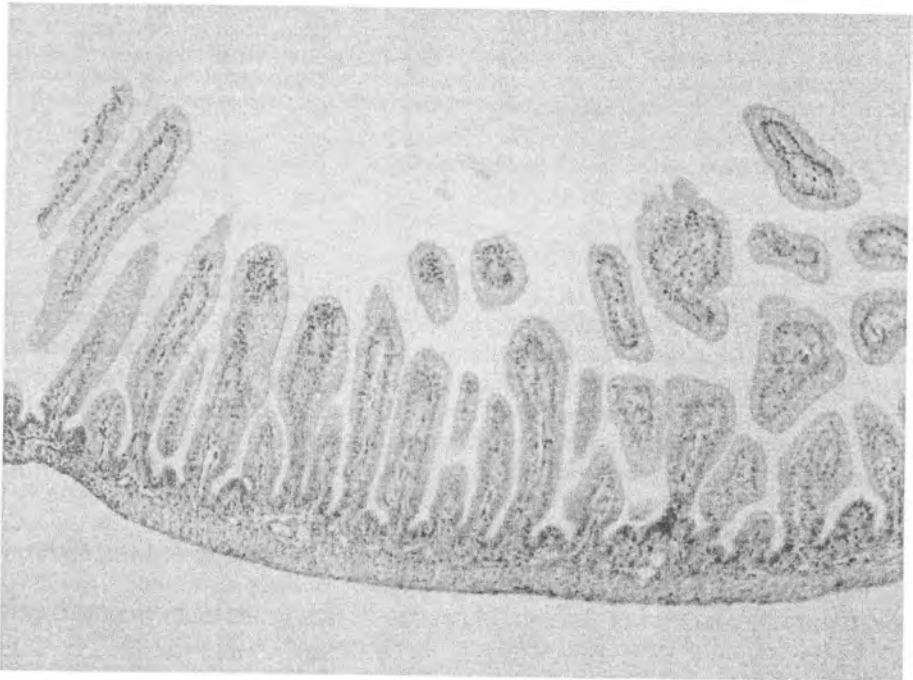


Fig. 1. Small intestine from a one-day-old rat. Parallel villi with an irregular shape. Shallow crypts of Lieberkuhn. Paraffin slides. HE,  $\times 4$ .

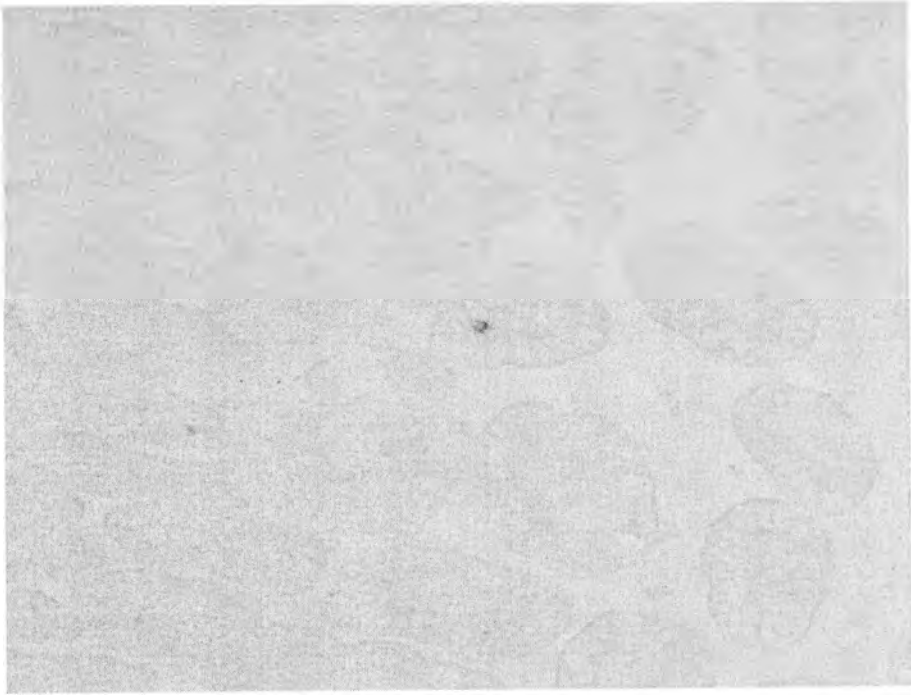


Fig. 2. Small intestine from a one-day-old rat. Transverse sections of villi. Expression of serotonin in the covering epithelium in one of the villi. Paraffin slides,  $\times 20$

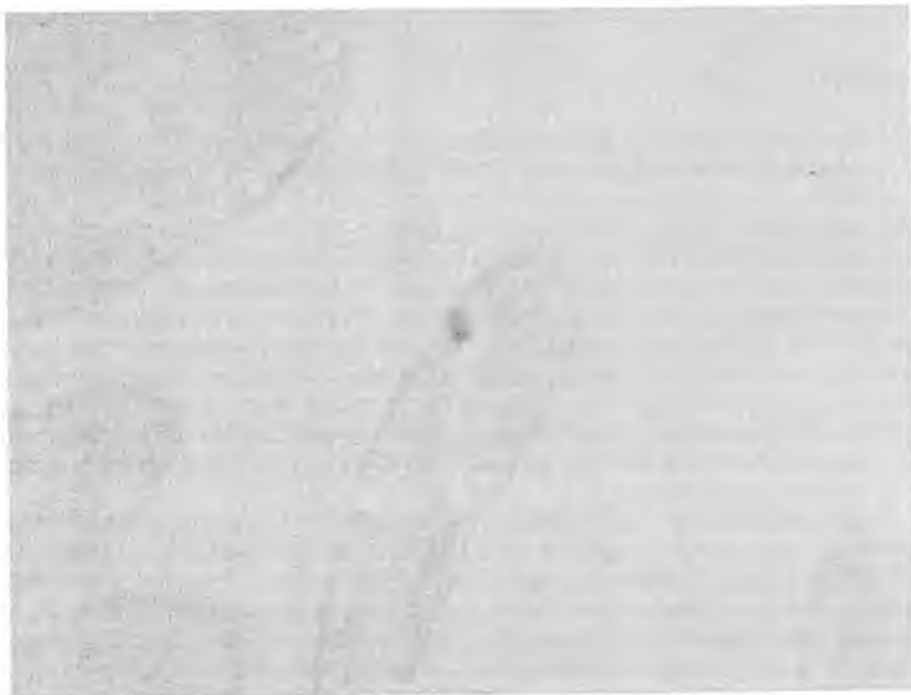


Fig. 3. Longitude slide of a villus of the small intestine of a one-day-old rat. Expression of serotonin in a cell from the covering epithelium. Paraffin slides,  $\times 40$

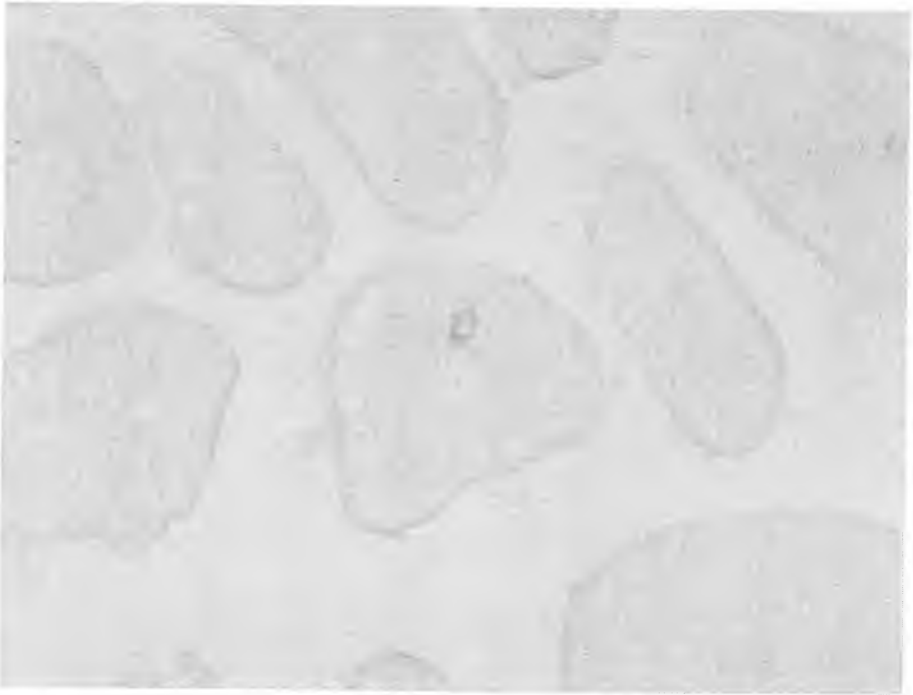


Fig. 4. Transverse section of a villus of the small intestine of a one-day-old rat. Expression of serotonin in the basal part of an EC cell. Paraffin slides,  $\times 40$

## Discussion

The adult intestinal epithelium is organized into villi, which project into the gut lumen. At the base of the villi are the crypts of Lieberkuhn which contain the stem cell compartment. That small group of proliferating undifferentiated stem cells produces the following phenotypes – absorption cells, goblet cells, enteroendocrine cells which migrate towards the nearby villi [4]. The migration of the cells along the proximo-to-distal and crypto-to-villus gradient is influenced by alterations in the composition of the extracellular matrix via cell surface receptors of epithelial cells that interact with proteins of the extracellular matrix [3]. Studying the regenerating processes of the superficial intestinal wounds Jaladanki N. R a o et al. (1999) [5] established that the regeneration of the damaged enterocytes of the intestinal villi is carried out through a migration of differentiated intestinal crypt cells towards the villi. The factors that damage the intestinal cell differentiation lead to decreased cell migration after superficial wounding of the mucosa.

The localization of EC cells in the mature intestinal wall in adults is predominantly in the crypts. In the early neonatal period the EC cells are situated along the villi and not in the shallow crypts. This localization of the EC cells in the villi is likely connected to the intense processes of migration of enterocytes from the crypts towards the villi during this period of accelerated growth. The differentiation of these cells has probably occurred in an earlier stage of development – fetal or embryonic.

## Conclusion

Differentiated enterochromaffin EC cells are present in the small intestine of one-day-old rats. They are situated separately, in small numbers in the covering epithelium of the villi. Through an investigation of the immunohistochemical expression of the serotonin in the gastrointestinal tract from earlier stages of embryonic development the moment of differentiation of the EC cells can be established.

## References

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