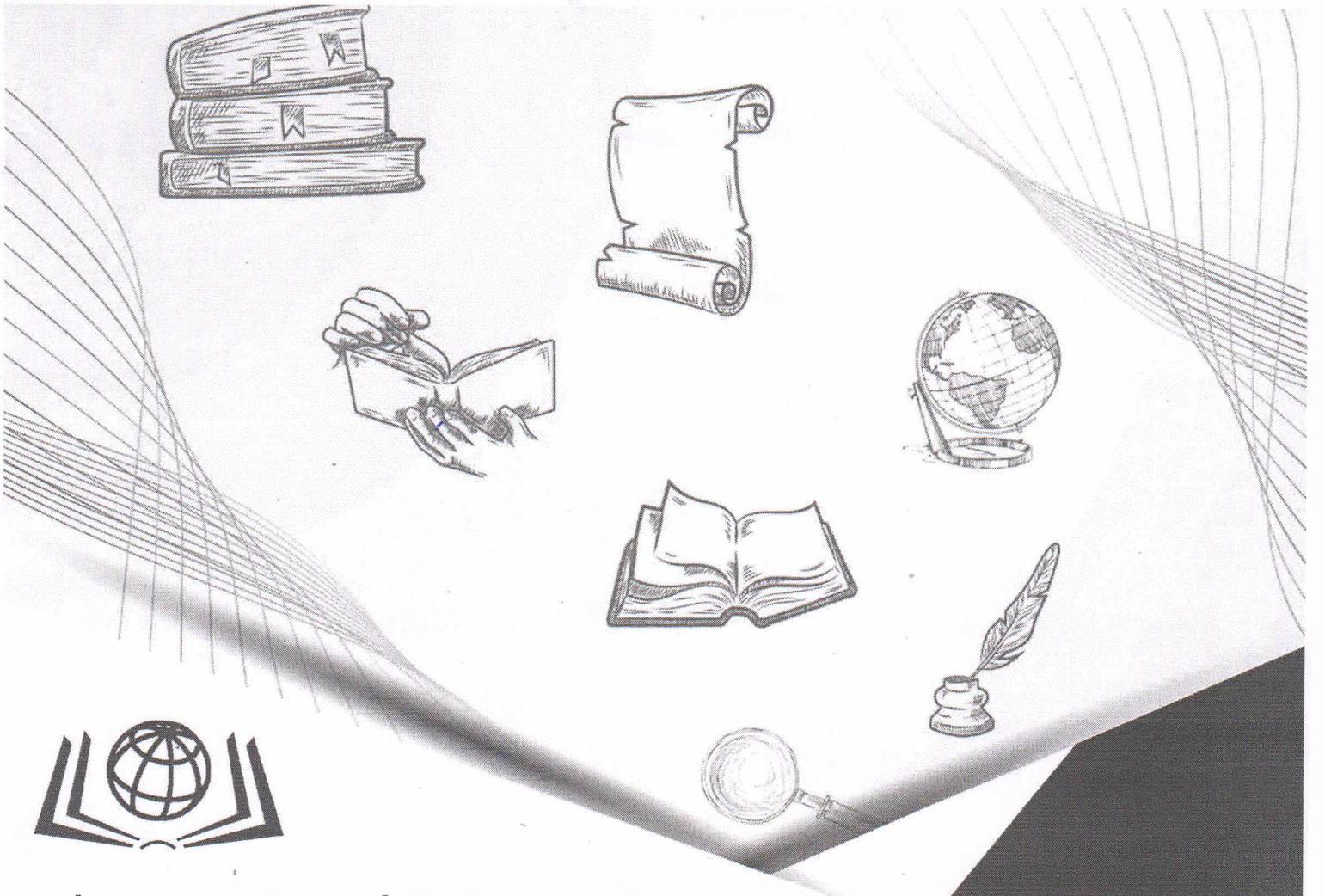

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THE STRUCTURE OF THE SMALL INTESTINE WALL IN RATS

Fomina L.
Professor of the Department of Human Anatomy
Vinnytsia National Medical University named after M.I.Pyrogov

Bondarchuk Hanna
PhD , University of Plymouth Peninsula Medical School
Faculty of Health

The work presents the morphology and morphometry of the normal rat jejunum wall. The results of the work conclude that the structure of the normal rat wall does indeed correspond to that in the human body and can serve as a subject for experimental studies, in particular when various negative factors affect the small intestine wall.

Key words: rats, small intestine, microcirculation, microscopic investigation, lymphoid nodules.

The structure of the small intestine wall of rats and humans is almost similar. Due to the spread of pharmacological production and the possibility of studying the modeling of some pathological conditions and their course, the study of the structure of the rat wall and its microcirculatory bed is necessary to replenish modern morphological information and for the correct extrapolation of the obtained data to the human body. Such a study is also a necessary prerequisite for planning and conducting experimental research.

The material for studying the normal structure of the wall of the small intestine of rats was biopsies of their small intestine (10 individuals) of male sex, weighing up to 180 g. Before being removed from the experiment, the rats were in a 14-day quarantine in the conditions of the vivarium of the scientific and experimental clinic of the Vinnytsia National Medical University named after M.I. Pirogov on a standard diet, with free access to water under 12-hour light day. Rats were removed from the experiment by dislocation of the cervical vertebrae under intrapleural thiopental anesthesia. Before removal from the experiment, the rats' digestive tube was filled with air as much as possible through the esophagus.

After withdrawal from the experiment, small intestine biopsies were taken at five locations for correct calculation of components. The study took into account the recommendations for laboratory animals and received permission from the Bioethics Committee of the Vinnytsia National Medical University named after M.I. Pirogov (protocol No. 15 of 06.12. 2024), Experimental material (rat jejunum) was fixed in 10% neutral formalin solution, washed with running water, dehydrated in alcohols of increasing concentration and embedded in paraffin. Sections 5-7 μm thick were made on a rotary microtome. To study morphocytoarchitectonics, hematoxylin-eosin and

Van Gieson staining were used (to determine changes in the specific gravity of the connective tissue of the small intestine wall).

Statistical processing of the results was carried out in the package "STATISTICA 5.5" (owned by the Central Research Institute of the Pirogov National Medical University, license number AXHR910A374605FA) using parametric methods of data evaluation. Based on the Student's t-test, the reliability of the difference in mean values was determined. Attention was paid to indicators whose difference in values was significant ($p<0.05$)) [2].

Results: The jejunum of rats was gray-pink in color, shiny, moist, and had a typical structure – the inner lining was mucous, the submucosal layer, the muscularis mucosae, and the serosa.

The mucous membrane of the jejunum was gray-pink in color, uniform in thickness – 489.8±31.2 microns and consisted of three layers – epithelial, lamina propria of the mucous membrane with a layer of muscles. The relief of the mucous membrane was represented by circular folds, villi and crypts. The epithelial lining was represented by a single-layered villous columnar epithelium [3, 4].

During histological examination, the mucosa of the jejunum was represented by intact finger-shaped villi (Fig. 1), at the base of which was located loose connective tissue of the mucosal lamina propria.

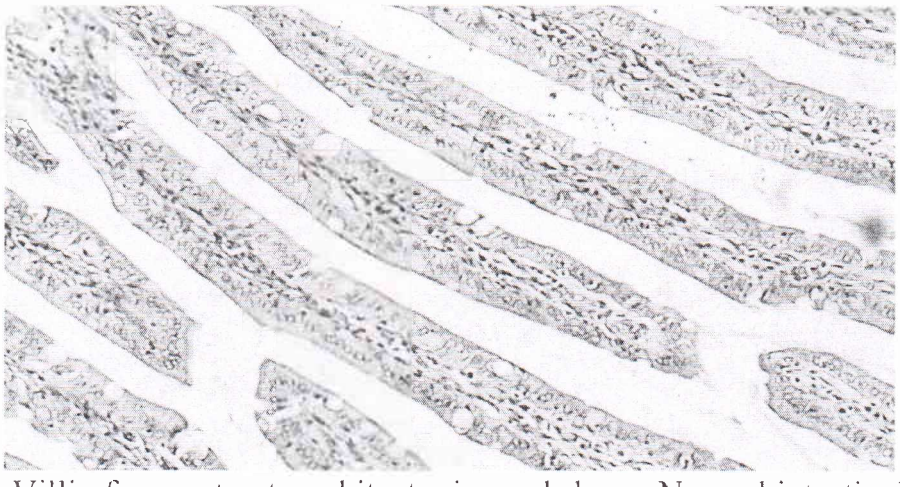

Fig. 1. Villi of correct cytoarchitectonics and shape. Normal intestinal lumen of rats. Hematoxylin-eosin. Magnification X200 [The authors].

The lamina propria contained single smooth muscle cells, between which were located microcirculatory vessels, mainly capillaries. On the surface of the villus there were three types of enterocytes - columnar epithelial cells measuring 21.58±0.69 μm, with a border of microvilli forming striated border, goblet-shaped exocrinocytes that produce mucus and occur with a frequency of 18.43±2.17 in one villus, and single exocrinocytes with acidophilic granules, the number of which was no more than 1% of epithelial cells, were located in the lower third of the villi and in the crypts.

Columnar epithelial cells were connected by tight junctions, which were formed from locking plates constructed from tonofilaments at the apical part of the columnar

epithelial cells. This structure prevents the entry of substances into the cell from the intestinal lumen.

Between the villi we observed crypts with a depth of 148.5±10.9 μm, which were formed by tubular ingrowth of the epithelium into the lamina propria of the mucous membrane, and contained the same cells. At the bottom of the crypt we noted prismatic cells with a large number of granules, which we considered to be exocrinocytes with acidophilic granularity. The exit from the crypt into the lumen of the small intestine was located between the base of two adjacent villi. We noted the uniform height of the villi, which was 300.3±8.53 μm. There were also single destroyed villi with desquamation of epithelial cells in the apical zone.

The lamina propria of the mucosa was represented by loose connective tissue, which contained many elastic and reticular fibers, and plexuses of hemomicrocirculatory vessels arranged in two layers. In some places, there were accumulations of lymphocytes in the form of single lymphoid follicles.

The extracellular matrix of the lamina propria of the jejunal mucosa was represented by plasma cells, stromal and neutrophilic lymphocytes and leukocytes, and tissue basophils.

In the villi, a classic pattern of vascular arrangement of the lamina propria of the mucosa was observed: arterioles, precapillaries, capillaries, postcapillaries, venules. The submucosal base was formed by loose connective tissue with inclusions of blood and lymphatic vessels (Fig. 2).

The muscularis mucosa had a two-layer structure with fibers located in longitudinal and circular directions (Fig. 3.4). The distribution of the specific gravity of the structural elements of the lamina propria of the mucosa, the submucosa and the muscularis mucosa in control rats is presented in Figures 3, 4, 5.

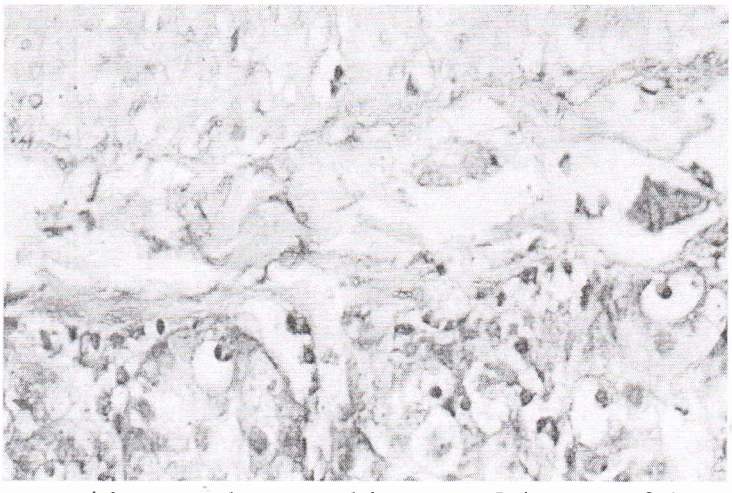

Fig. 2. Submucosa with normal cytoarchitecture. Jejunum of the control group of rats. Hematoxylin-eosin. Magnification X400 [The authors].

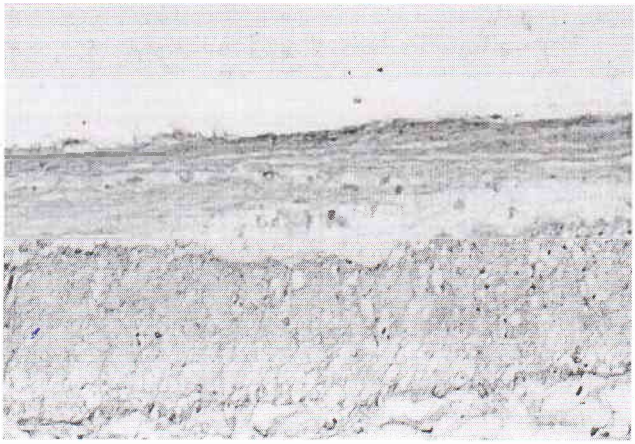

Fig. 3. Muscular membrane with normal cytoarchitecture. Jejunum of control group of rats. Hematoxylin-eosin. Magnification X400 [The authors].

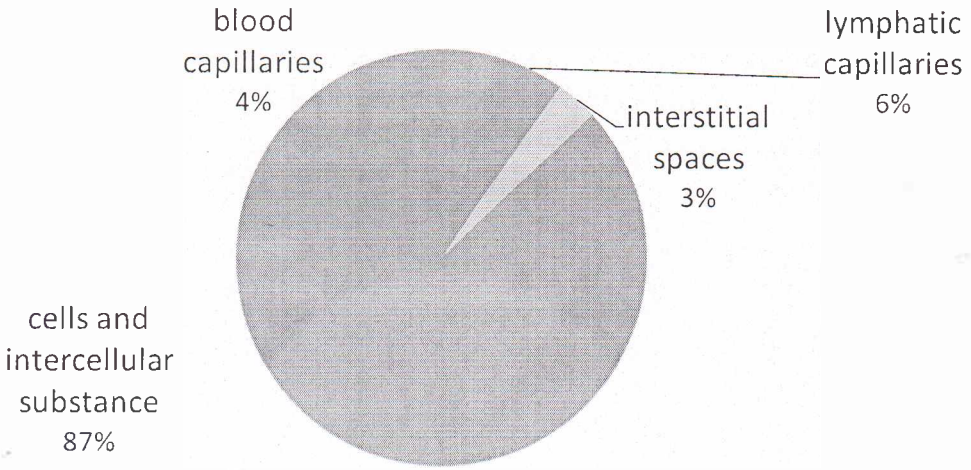

Fig. 4. Specific gravity of microcirculatory vessels, cells and intercellular substance in the lamina propria of the jejunal mucosa of the control group of rats.

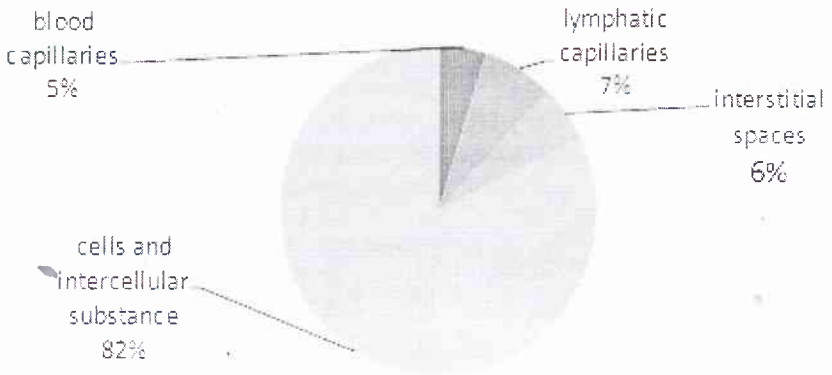

Fig. 5 Specific gravity of microcirculatory vessels, cells and intercellular substance in the submucosa of the jejunum of the control group of rats.

The activity of tissue regeneration of the jejunum was determined: the mitotic index was 17±2.28; the apoptotic index was 7.7±0.39. Thus, the activity of tissue regeneration in the control group of animals was 2.2±0.19. Pathological mitoses (chromosome geometry disorders, K-mitoses) were not noted. Mitotic figures were more common in the lower third of the villus and very rarely in the middle and upper.

A moderate amount of fiber was found in the lumen of the jejunum of intact animals.

The main part of the connective tissue in the preparations of the control group of rats was the submucosal base (Fig. 6). The specific weight of the connective tissue in the villi and in the lamina propria of the mucous membrane was 3.13±0.41%.

Thus, as a result of the analysis conducted in this section, material was obtained for a correct comparison of the data with the following experimental ones.

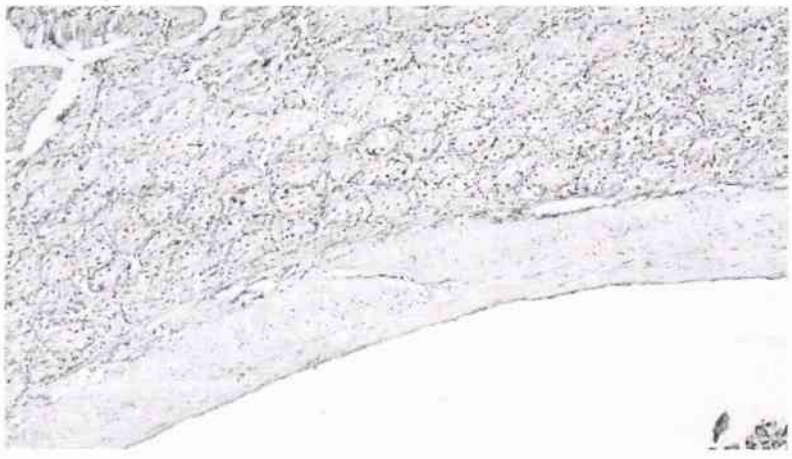

Fig. 6. Location of connective tissue (red). Jejunum of rats. Van Gieson. Magnification X200 [The authors].

Thus, the structure of the rat wall normally corresponds to that in the human body and can serve as a subject for experimental studies, in particular when various negative factors affect the wall of the small intestine.

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