

Intestinal glands in Vertebralis (1)

Cyclostomes: The patches of secretory cells are found in the epithelium of the anterior part of the intestine. These cells are of two types: (a) zymogen cells that secrete pancreatic enzymes that are tryptic in nature (cause lysis of proteins) and the cells of the follicles of Langerhans that regulate the blood glucose level. No intestinal juice or succus entericus is produced.

Fishes: In elasmobranchs e.g. Scoliodon, numerous tiny microscopic glands are situated in the walls of the small intestine and they secrete intestinal juice or succus entericus that contains enzymes that help in digestion. Some enzymes (almost) as found in mammals, so enlist the enzymes under Mammals only.
In teleost also same type of numerous tiny glands found.

Amphibians: In amphibians also tiny microscopic glands are situated in the walls of the ~~intestines~~ small intestine and they secrete intestinal juice or succus entericus that contains enzymes for digestion.

Reptiles + Birds — same as in amphibians

Mammals: The intestinal wall contains two types of glands — (1) Intestinal glands also called Crypts of Lieberkuhn (2) Brunner's glands.

(1) Crypts of Lieberkuhn: They are simple tubular glands found throughout the small intestine. These crypts secrete ^{most of} the enzymes of the intestinal juice also called succus entericus.

The intestinal juice or succus entericus:

The intestinal juice is alkaline (pH-8.3). Its secretion is stimulated by two hormones — duocrenin and enterocinin that are secreted by the duodenal epithelium. ~~This~~ intestinal juice contains following enzymes:

(1) Aminopeptidase: It hydrolyses peptones (a soluble protein formed in the early stage of protein breakdown by ~~gastric~~ pepsin ~~or~~ etc) into dipeptides and amino acids.

(2) Dipeptidase - They hydrolyse dipeptides into amino acids

(3) Intestinal Amylase: It hydrolyses starch, glycogen and dextrin to maltose, isomaltose and "limit" dextrin resp.

(4) Maltase: It converts disaccharide maltose into glucose. (Maltose is made up of two molecules of glucose)

(5) Isomaltase: It breaks isomaltose into glucose (Isomaltose is made up of two molecules of glucose just like Maltose but it is actually the isomer of Maltose with different linkage(s))

(6) Sucrase: It converts sucrose into glucose + fructose (3)

(7) Lactase: converts lactose into glucose + galactose.

Maltose, isomaltose, sucrase + lactase are collectively called disaccharidases as they hydrolyse disaccharides (double sugars) into monosaccharides.

(8) Intestinal lipase: It breaks down fats into fatty acids + glycerol.

(9) Nucleases (Ribonuclease + Deoxyribonuclease)
They split nucleic acids RNA and DNA into nucleotides.

(10) Nucleotidases: These enzymes break down nucleotides into nucleosides and phosphoric acid.

(11) Nucleosidases: These enzymes break the nucleosides into pentose sugars and nitrogen bases.

(12) Enterokinase: It activates the pancreatic trypsinogen to trypsin.

Along with these enzymes, some mucus is also produced by the Goblet cells of the intestinal gland. The mucus protects the intestinal lining.

[The intestinal glands are formed by the invagination of the ^{simple} columnar cells of the intestinal epithelium between the bases of the villi into the lamina propria, reaching almost the muscularis mucosa.]

(b) Brunner's glands: They are branched tubular glands confined to the duodenum. They lie in the submucosa. Their ducts pass through the muscularis mucosae to open into the crypts of Lieberkühn. They secrete alkaline watery fluid, little enzyme and mucus. They are unique to mammalian species.