# 11-000
# Digestive System
# 3

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# 11 Digestive System 3
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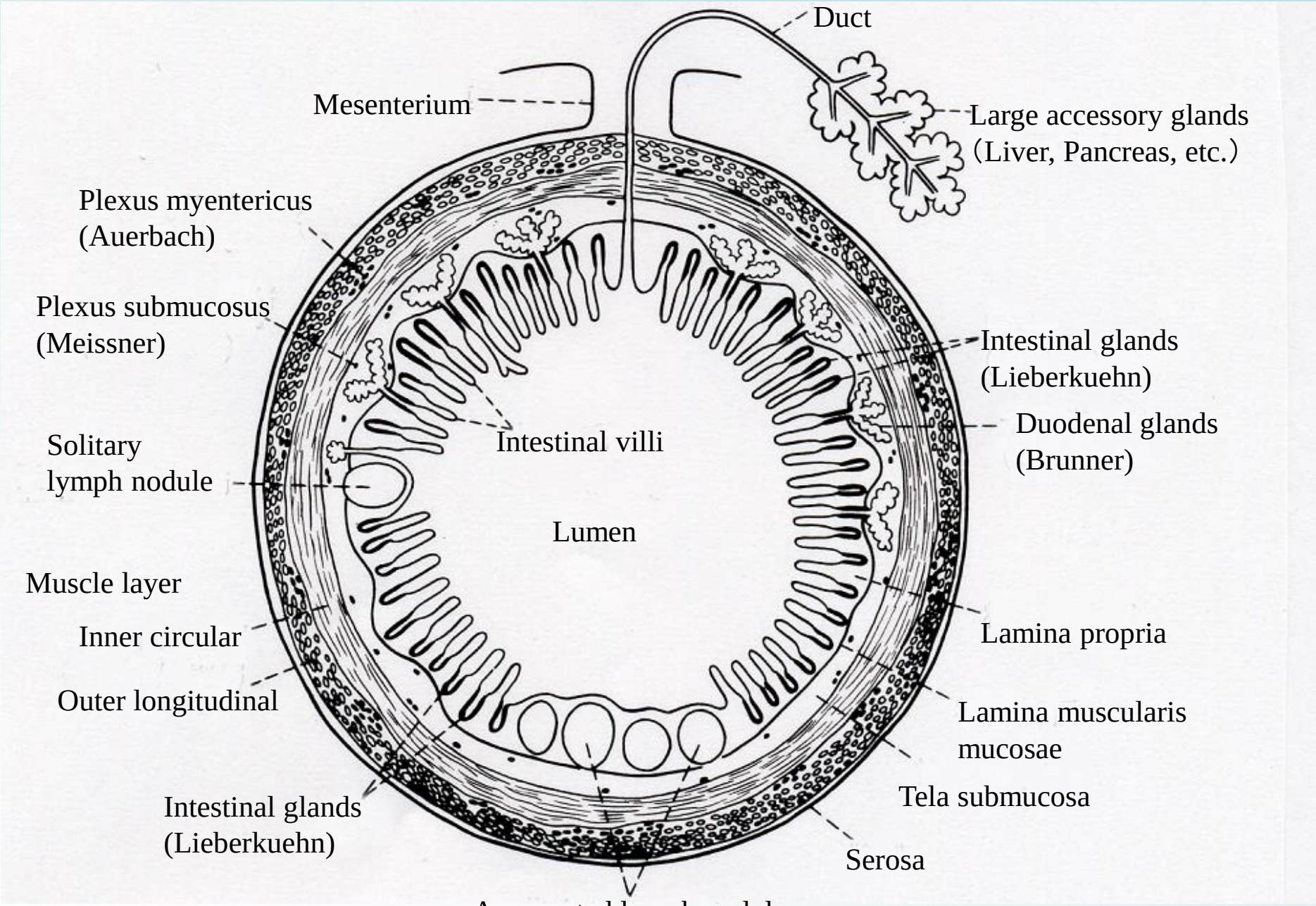
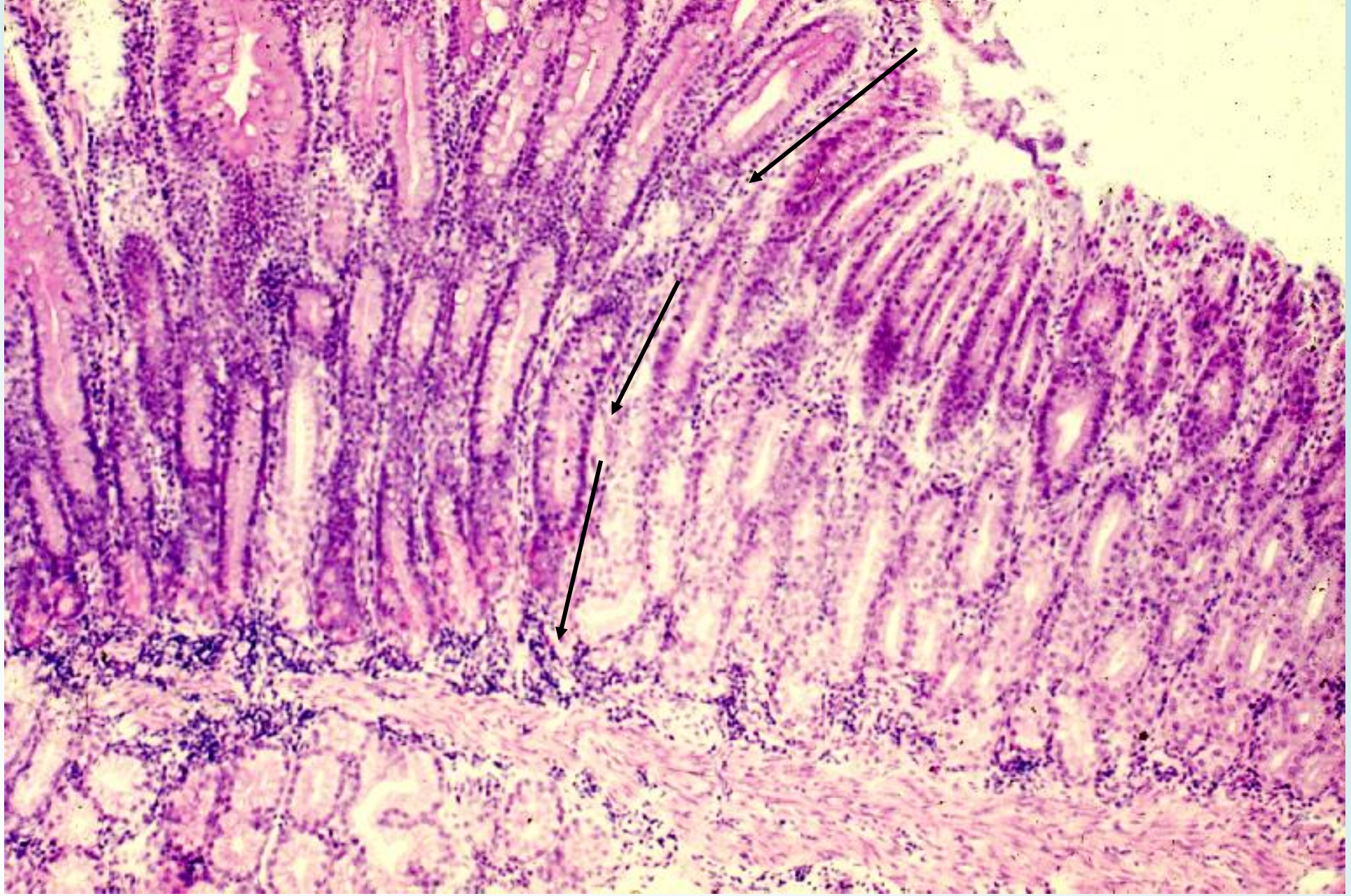
# 11-001
# Small Intestines

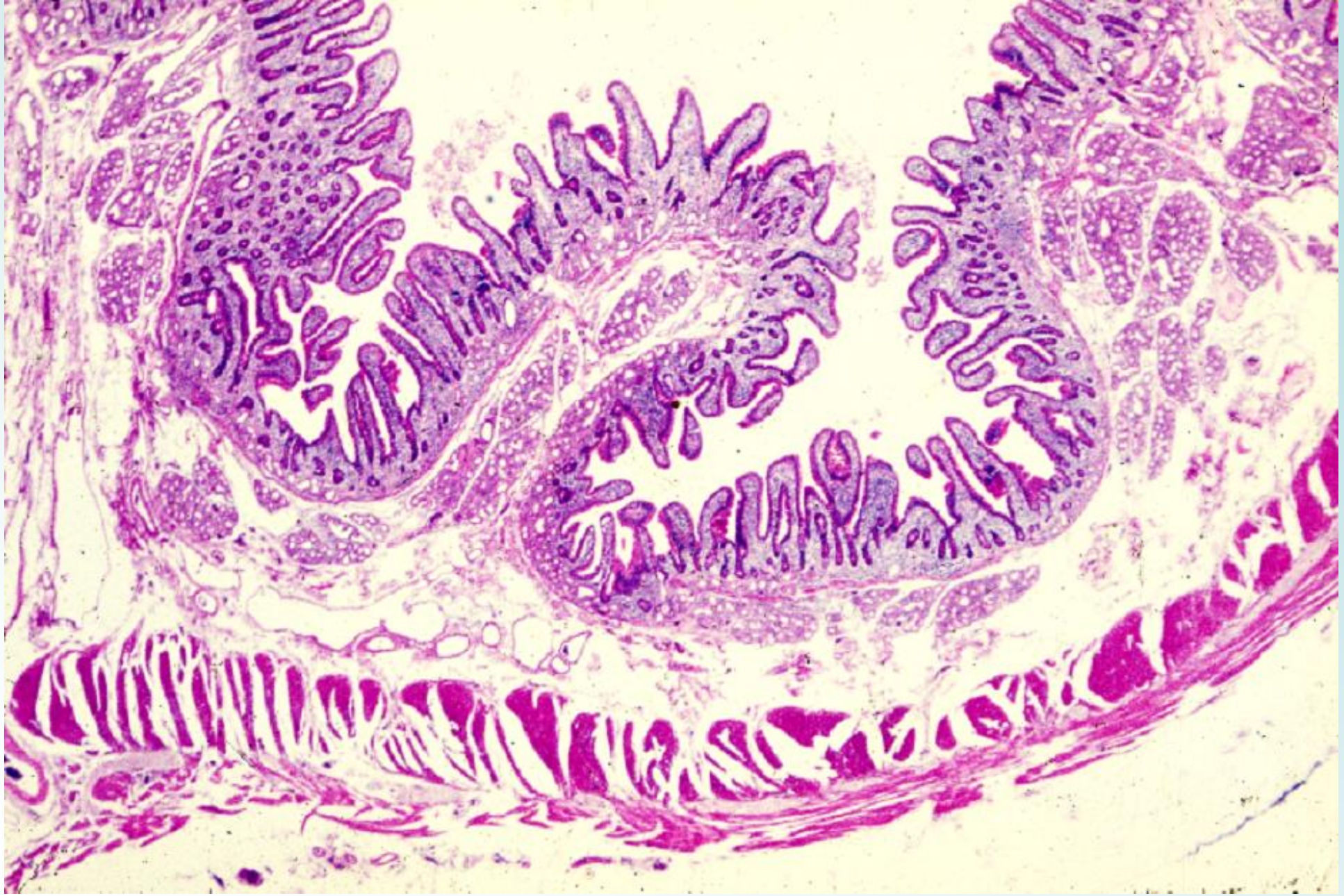



# 11-01 General structure of the digestive system（Scheme）

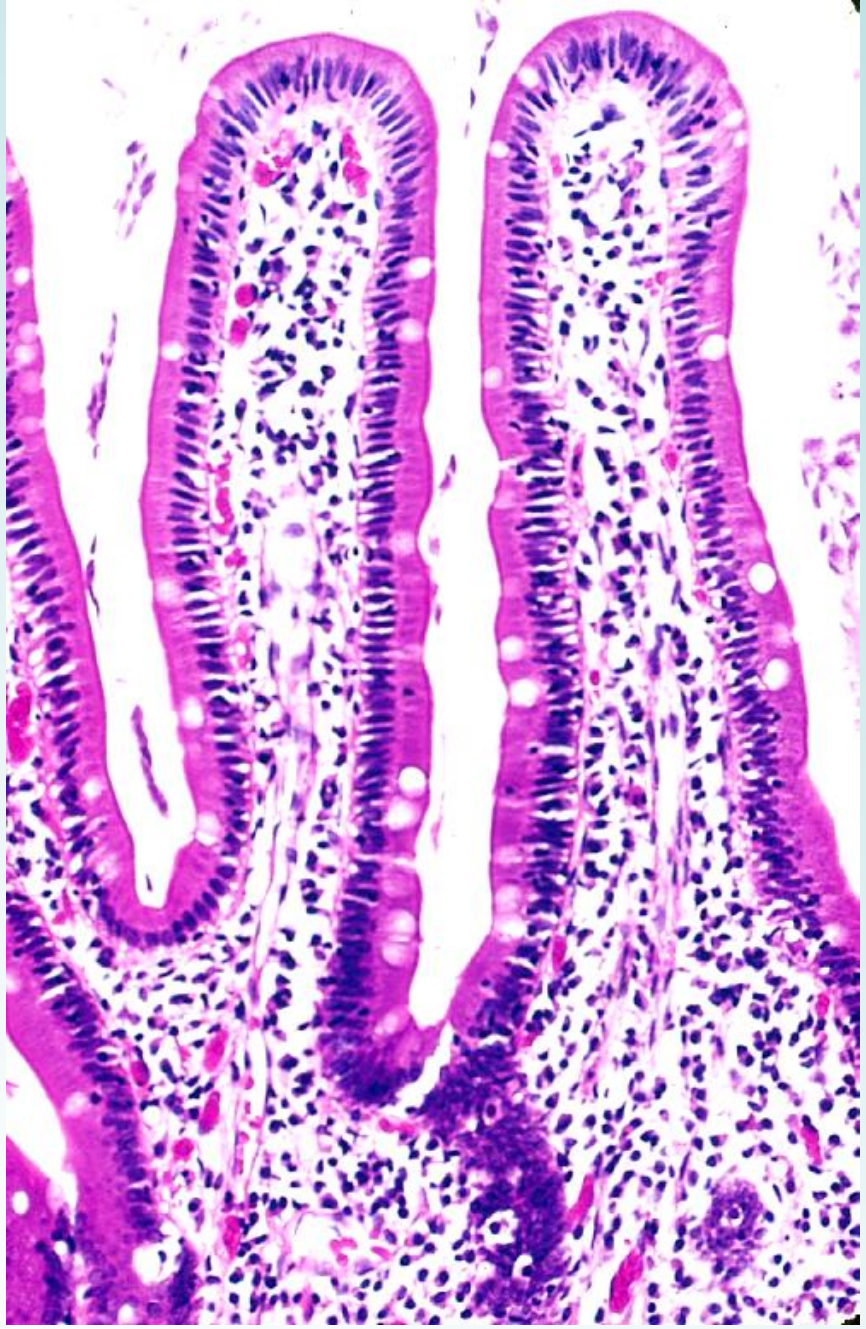
11-02 Pylorus, longitudinal section, 1. Monkey, H-E stain, x 3.0.



11-03 Pylorus, longitudinal section, 2. Monkey, H-E stain, x 25.

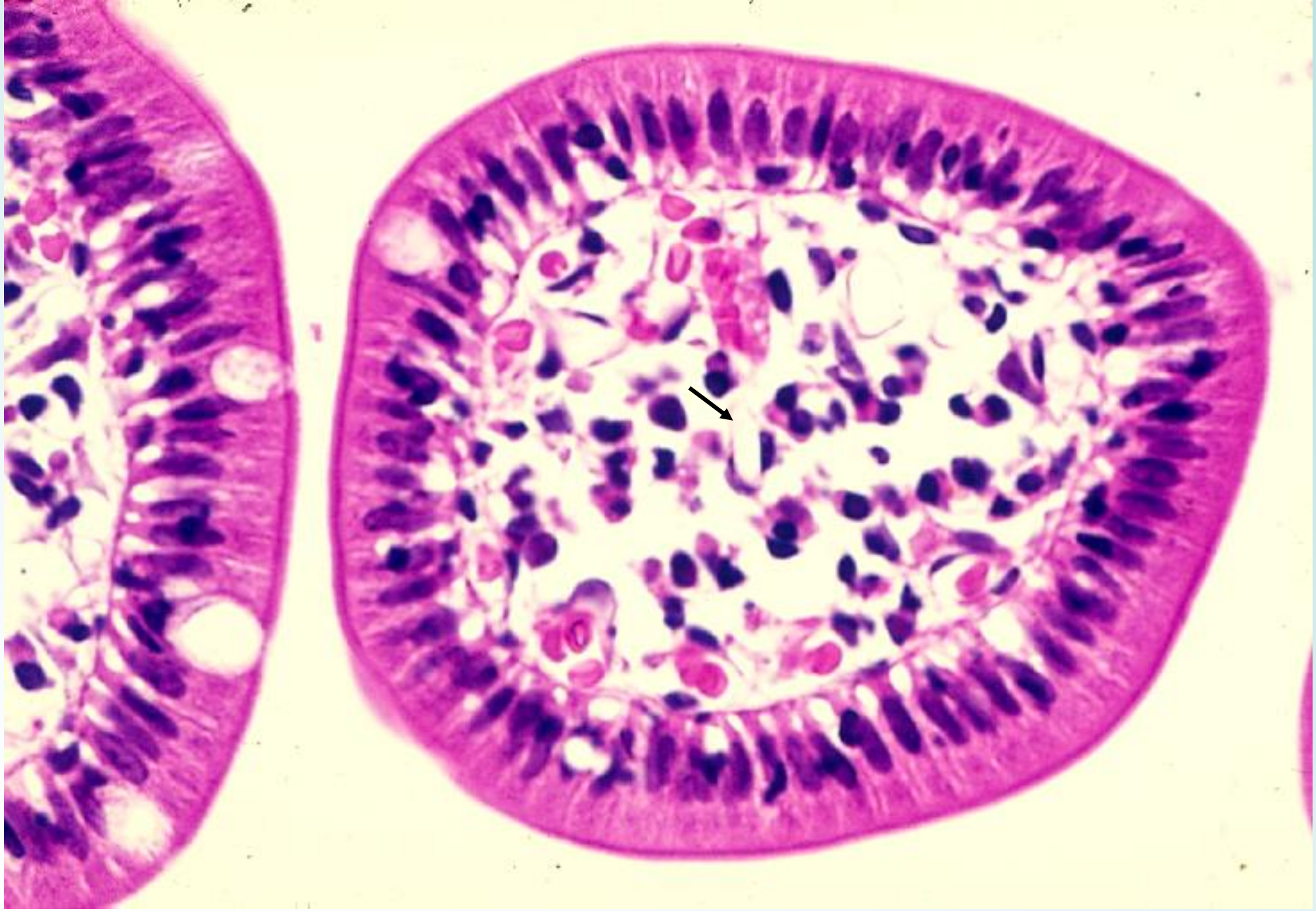


11-04 Duodenum, longitudinal section. Human, H-E stain, x 4.



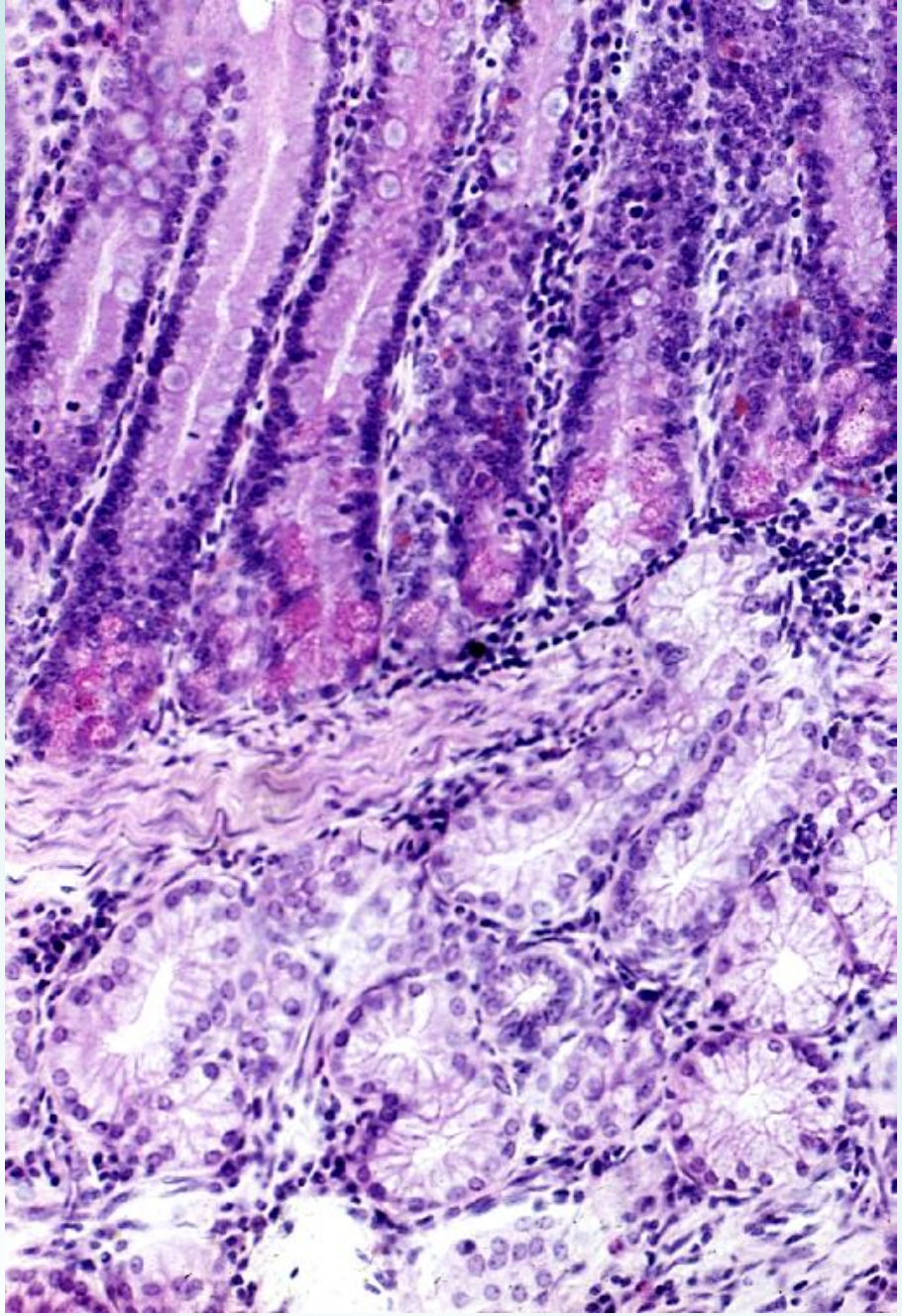
11-05 Intestinal villi, longitudinal section 1. Human, H-E stain, x 64.

11-06 Intestinal villus, longitudinal section 2. Human, H-E stain, x 160.



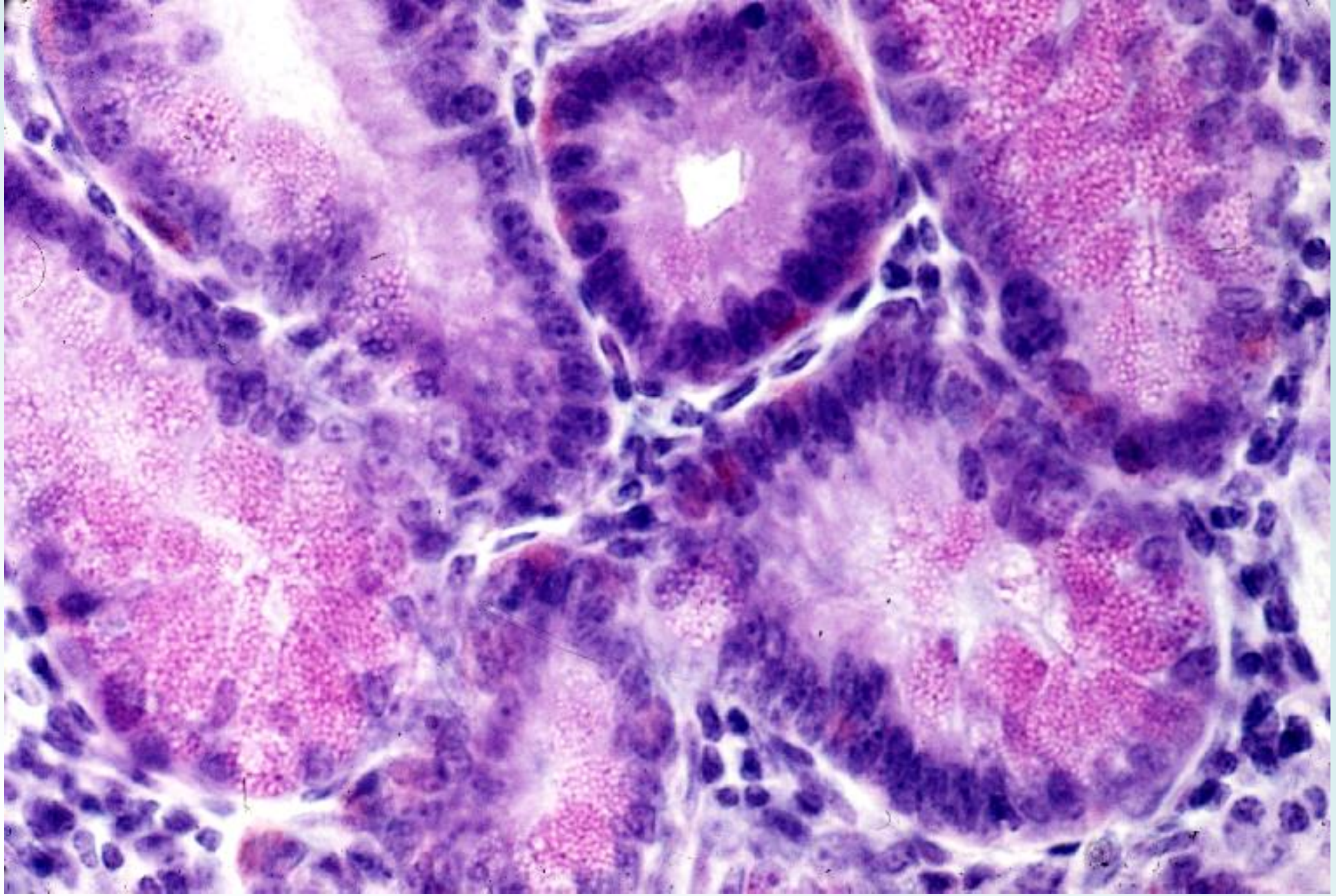
11-07 Intestinal villus, transverse section. Human, H-E stain, x 160.

11-08 Intestinal glands and duodenal glands 1. Human, H-E stain, x 25.

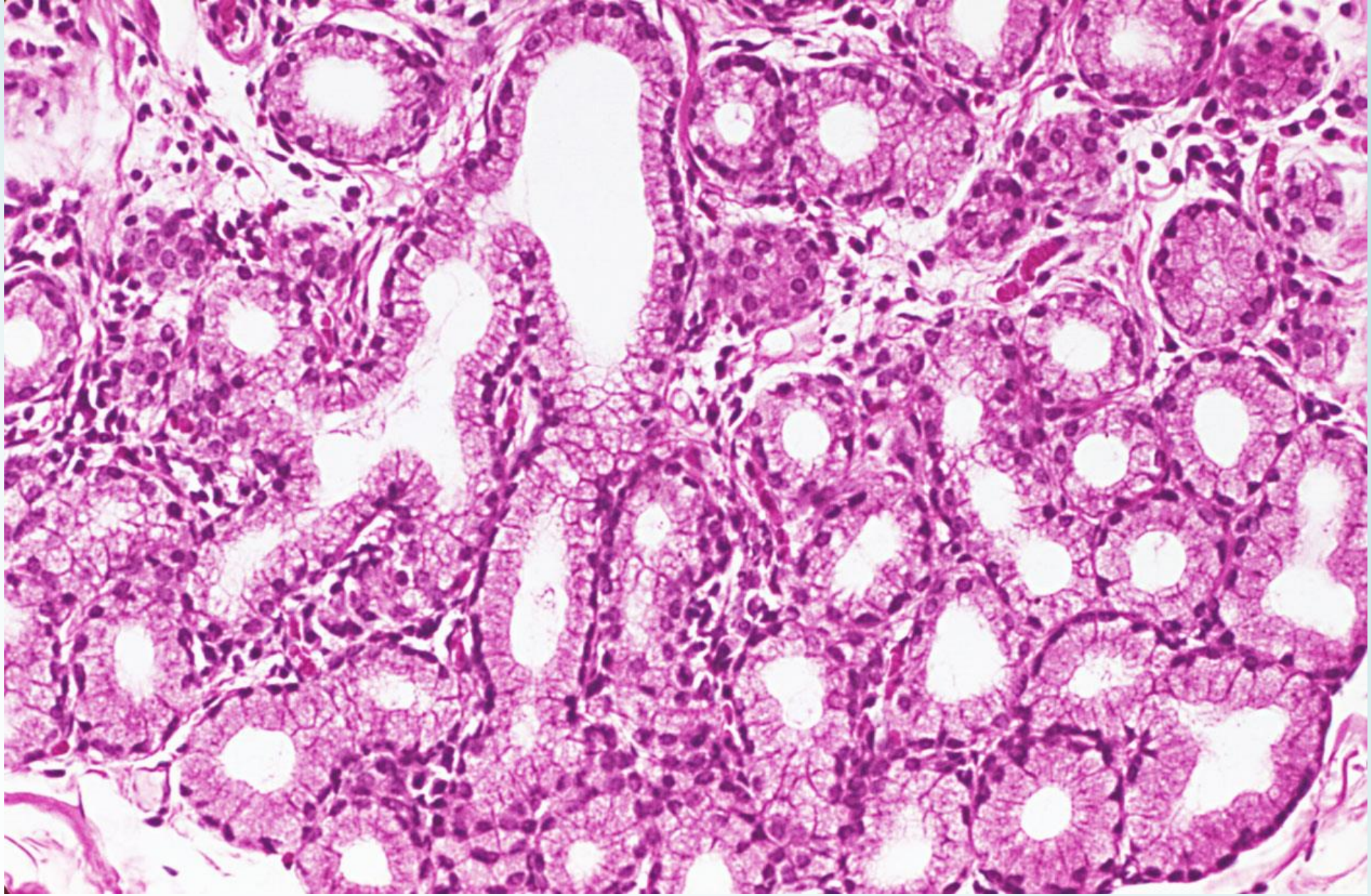


11-09 Intestinal glands and duodenal glands 2. Human, H-E stain, x 64.

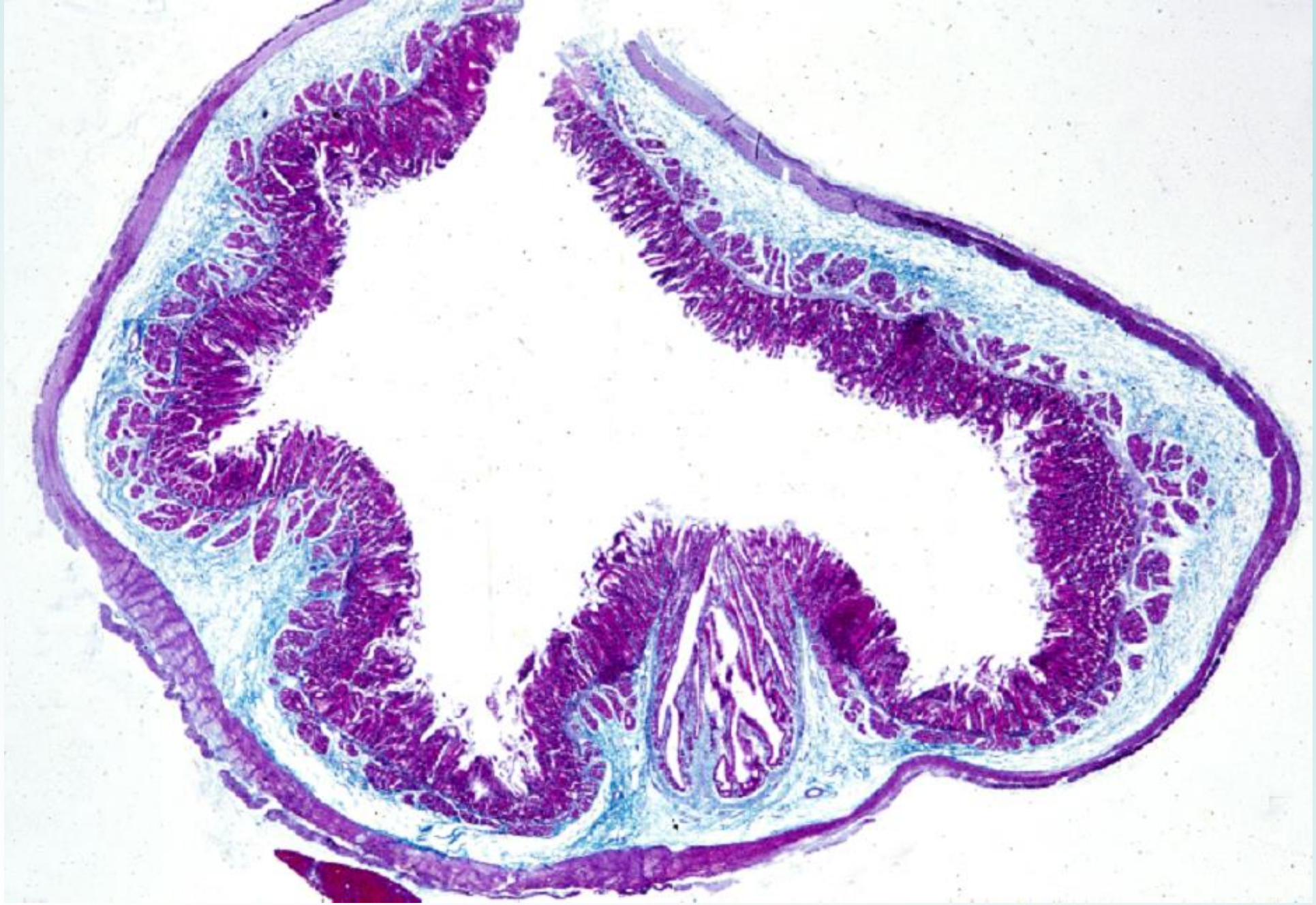
11-10 Intestinal gland, longitudinal section. Monkey, H-E stain, x 400.



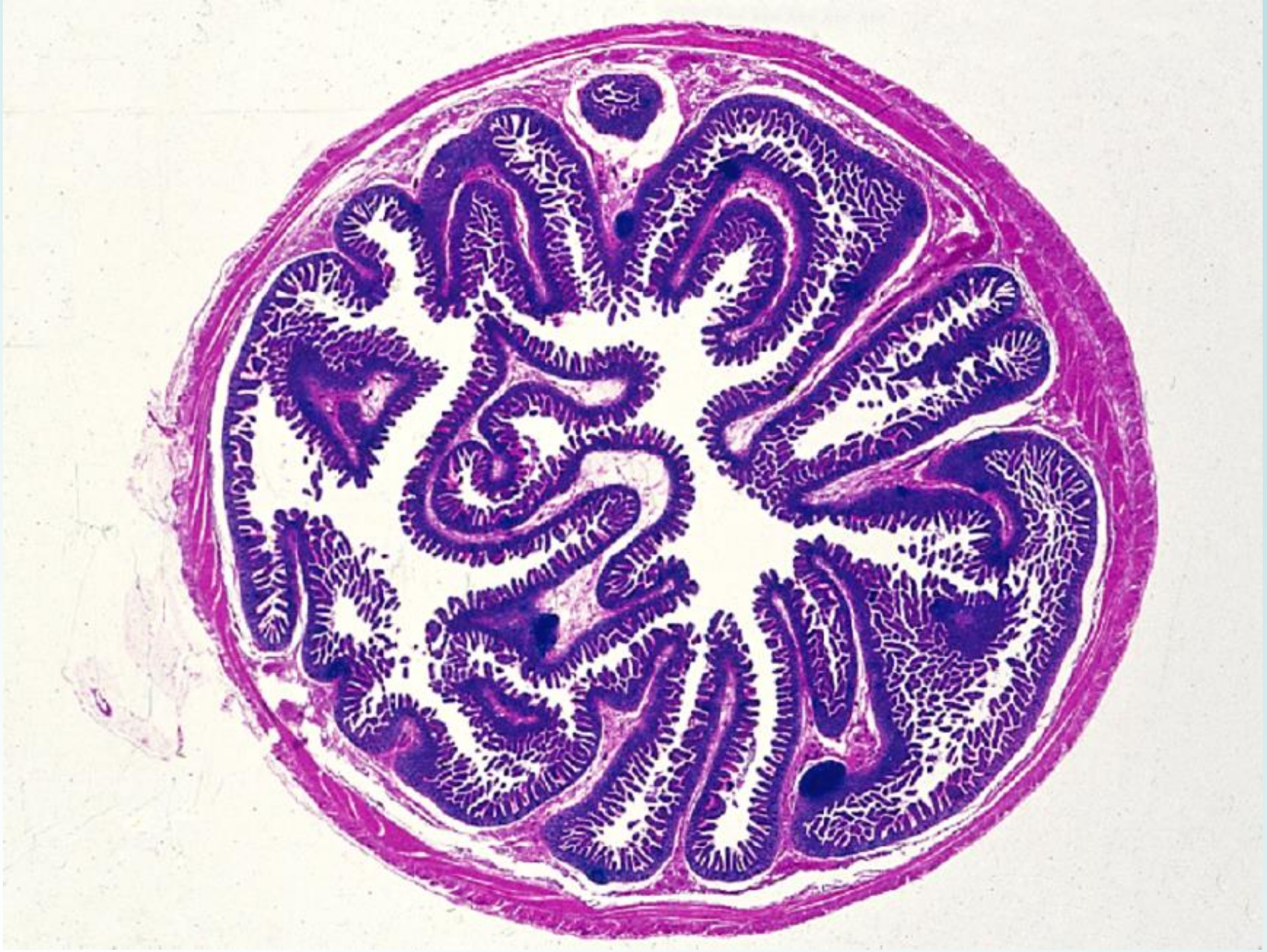
11-11 Intestinal glands, transverse section. Monkey, H-E stain, x 160.



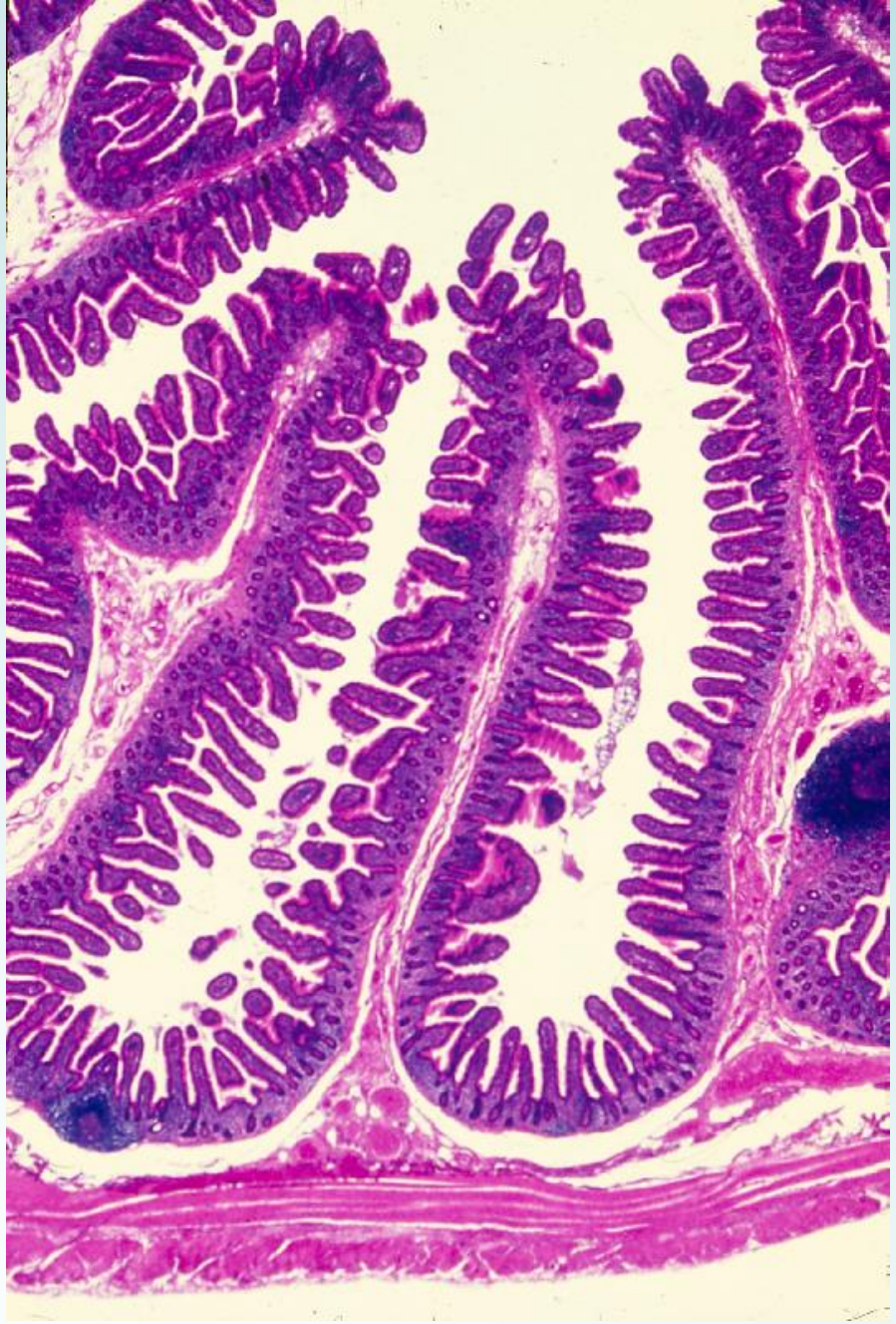
11-12 Duodenal gland. Human, H-E stain, x 64.



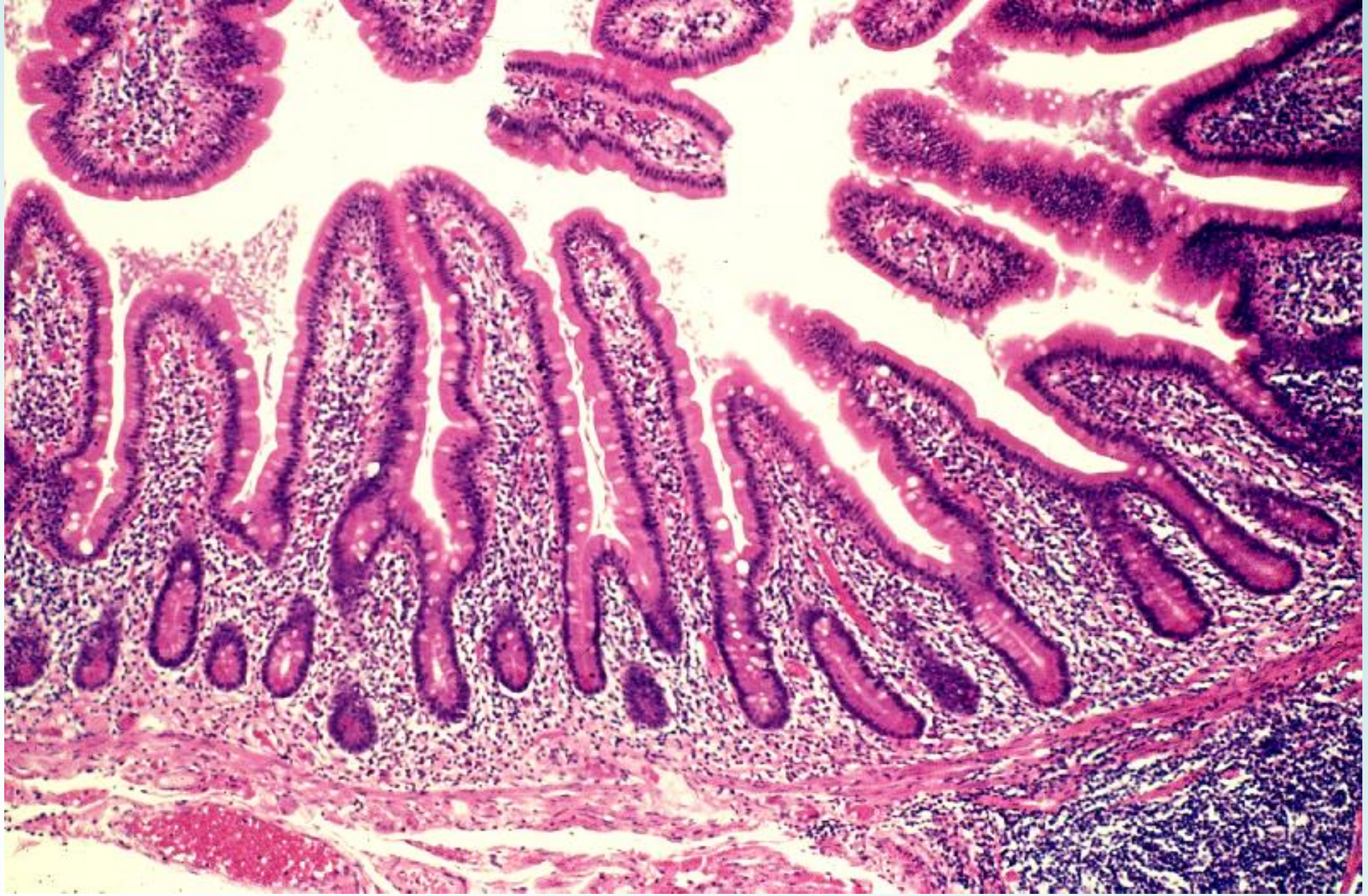
11-13 Papilla duodeni major, transverse section. Monkey, Azan stain, x 2.3.



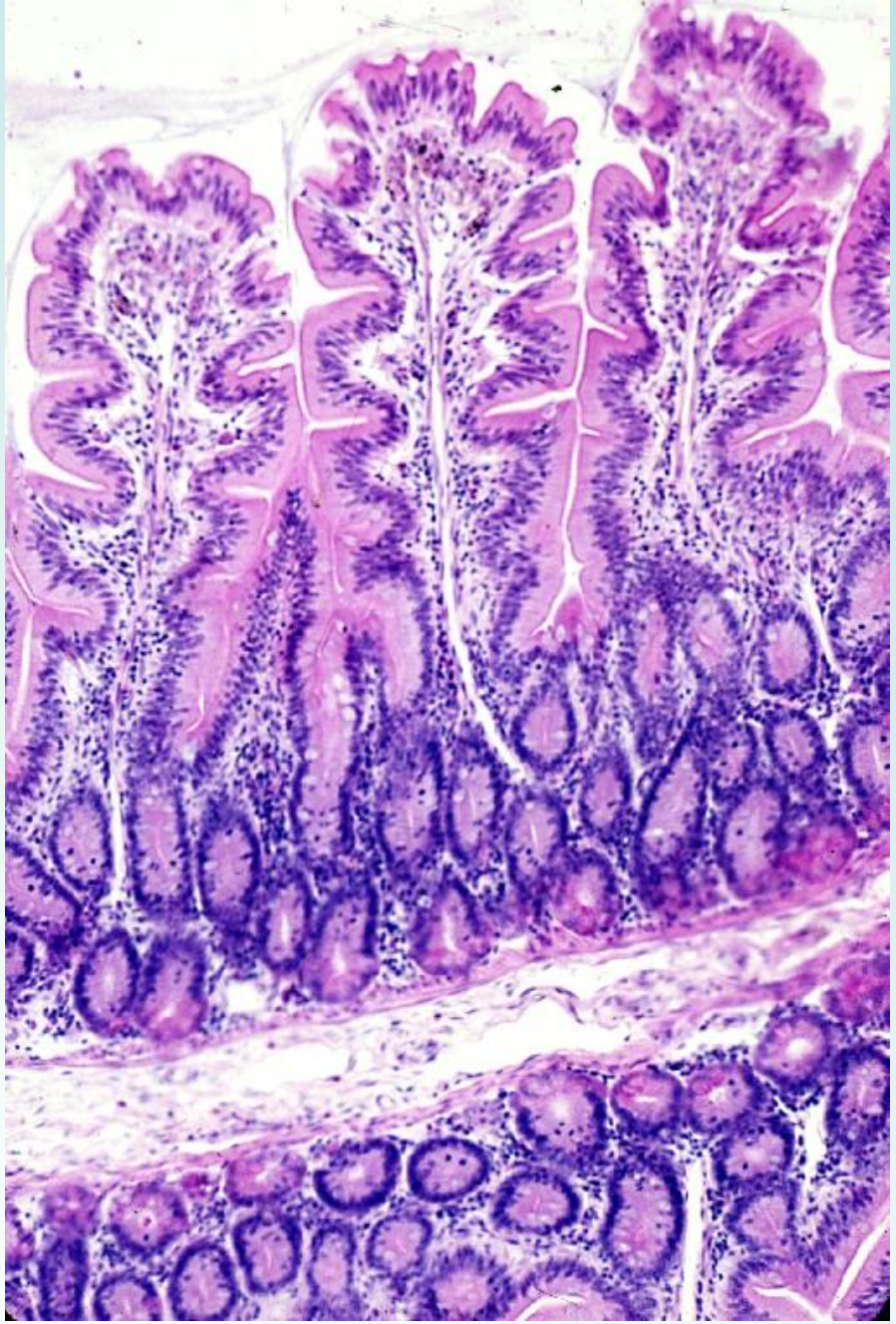
11-14 Jejunum, transverse section. H-E stain, x 1.2.



11-15 Jejunum, plicae circulares. Human, H-E stain, x 4.

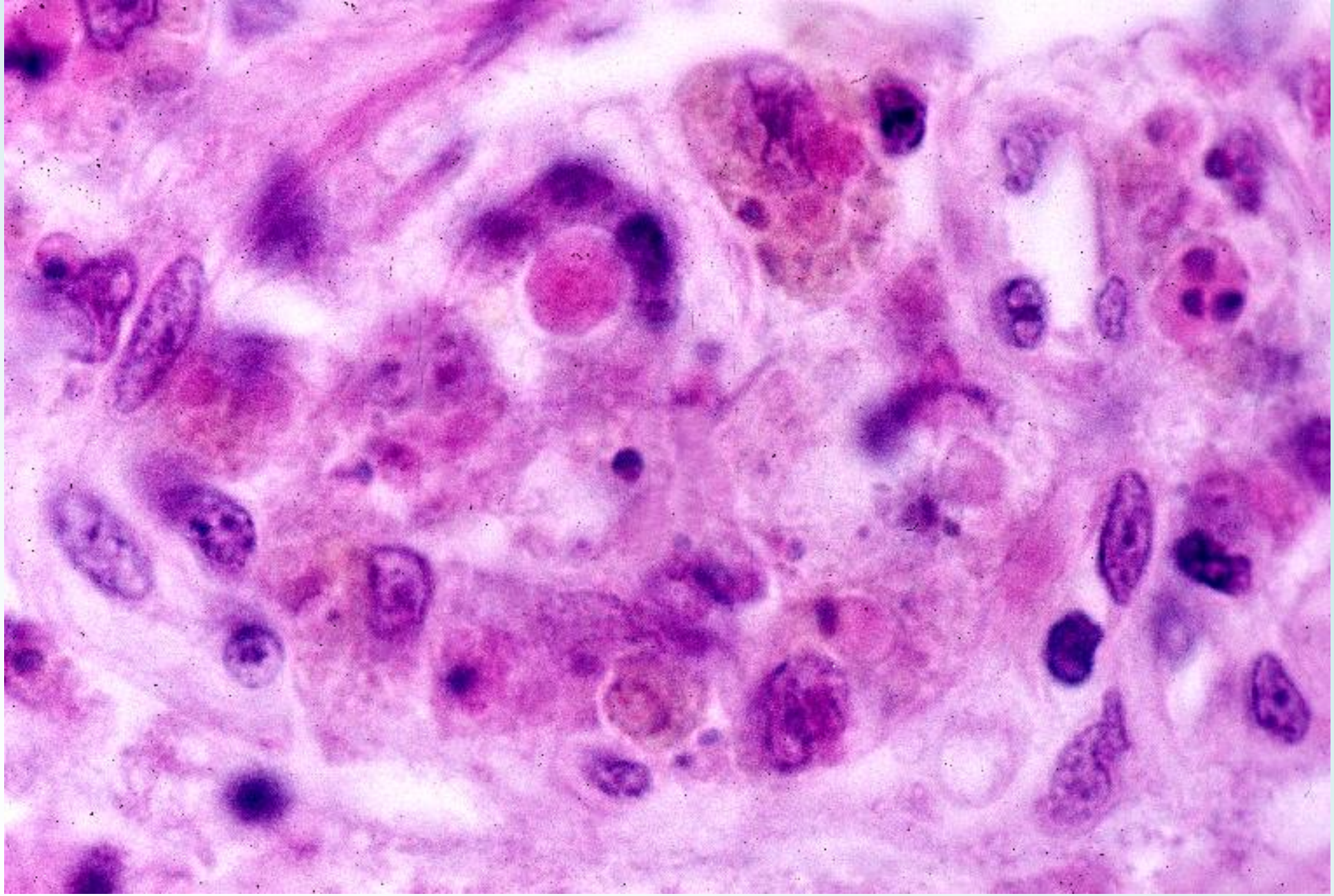


11-16 Jejunum, mucous membrane. Human, H-E stain, x 10.

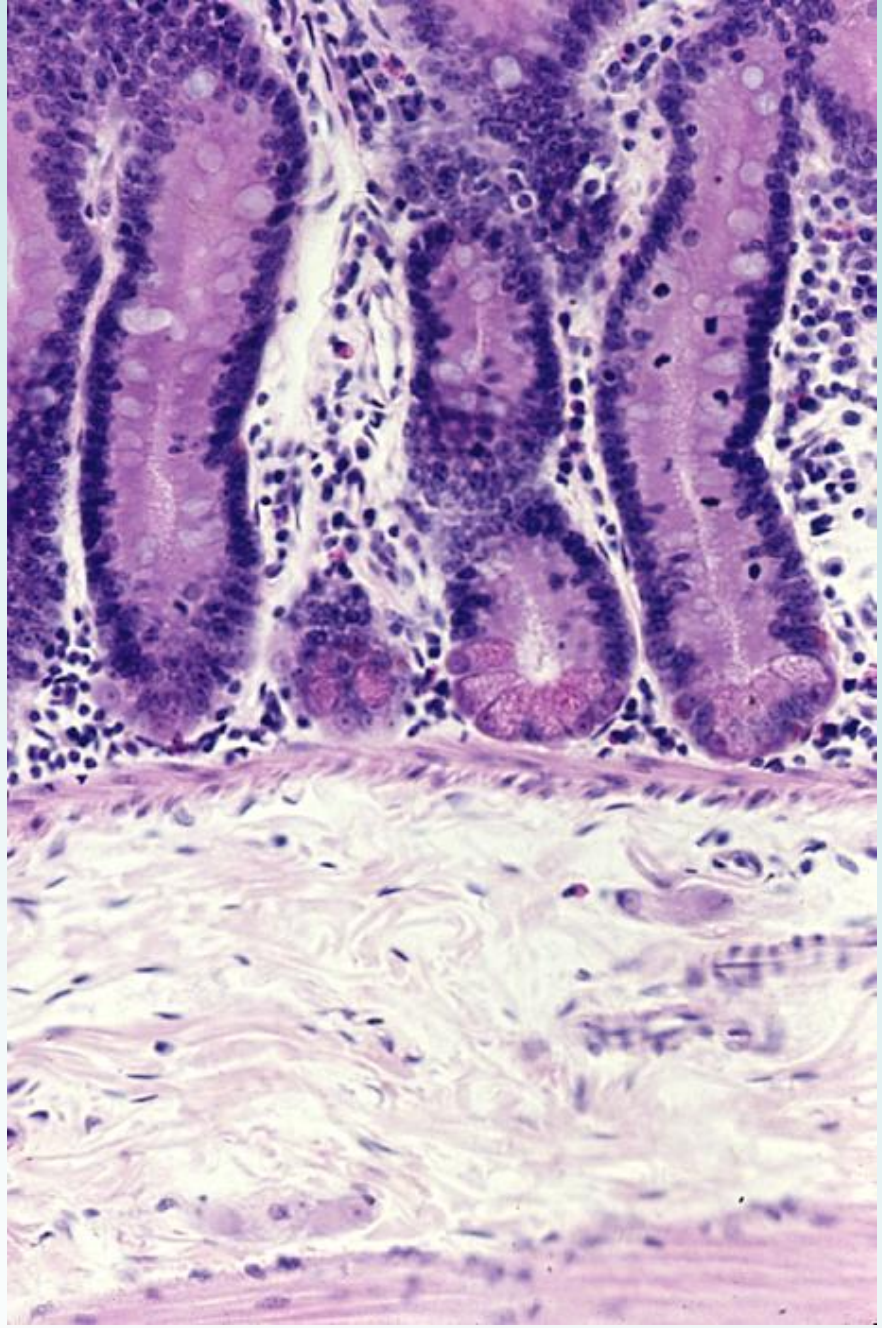


11-17 Jejunum, plica circularis. Monkey, H-E stain, x 30.


11-18 Intestinal villus, longitudinal section. Monkey, H-E stain, x 64.



11-19 Macrophages in the lamina propria of an intestinal villus. Monkey, H-E stain, x 400.

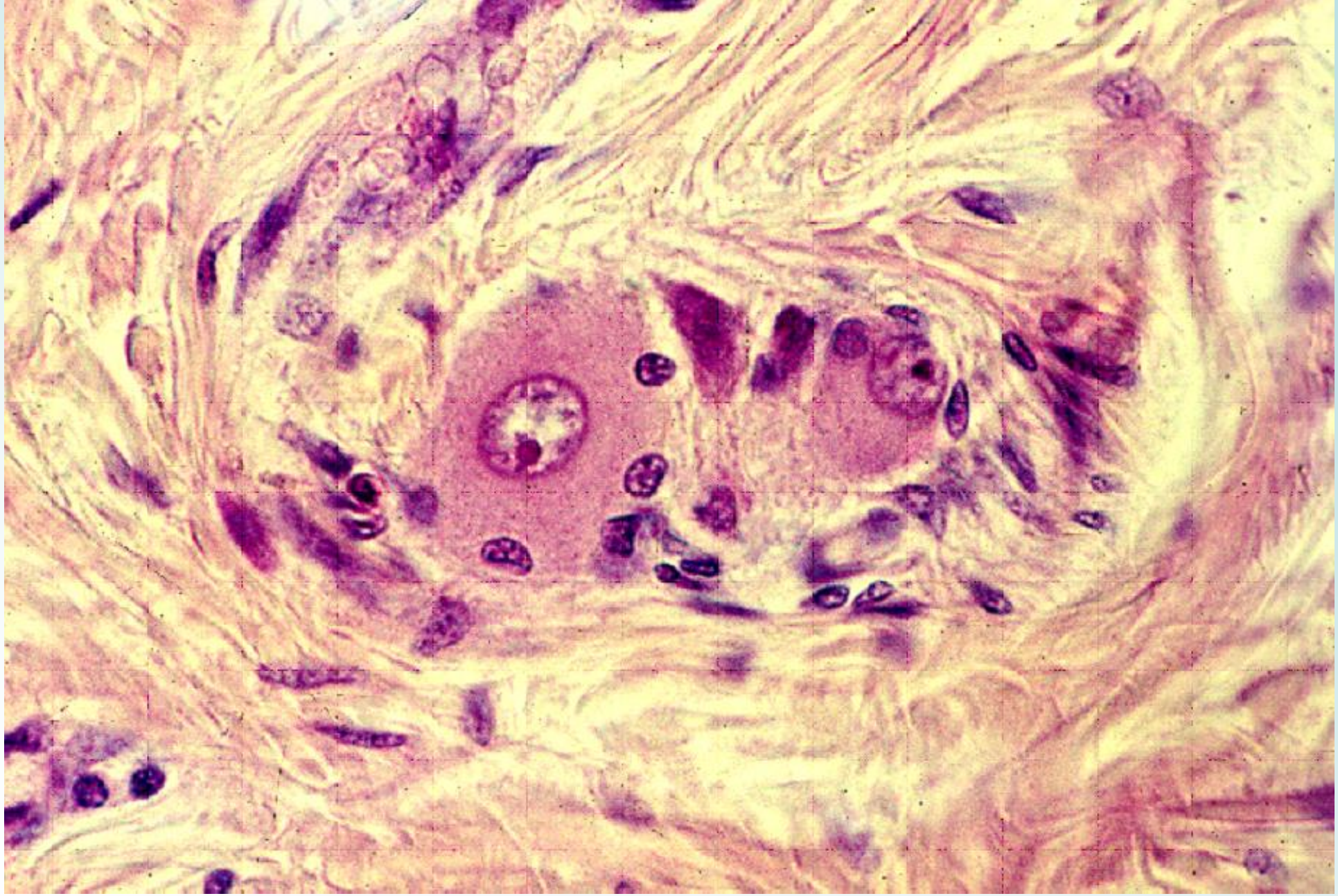


11-20 Intestinal glands and tela submucosa. Monkey, H-E stain, x 64.

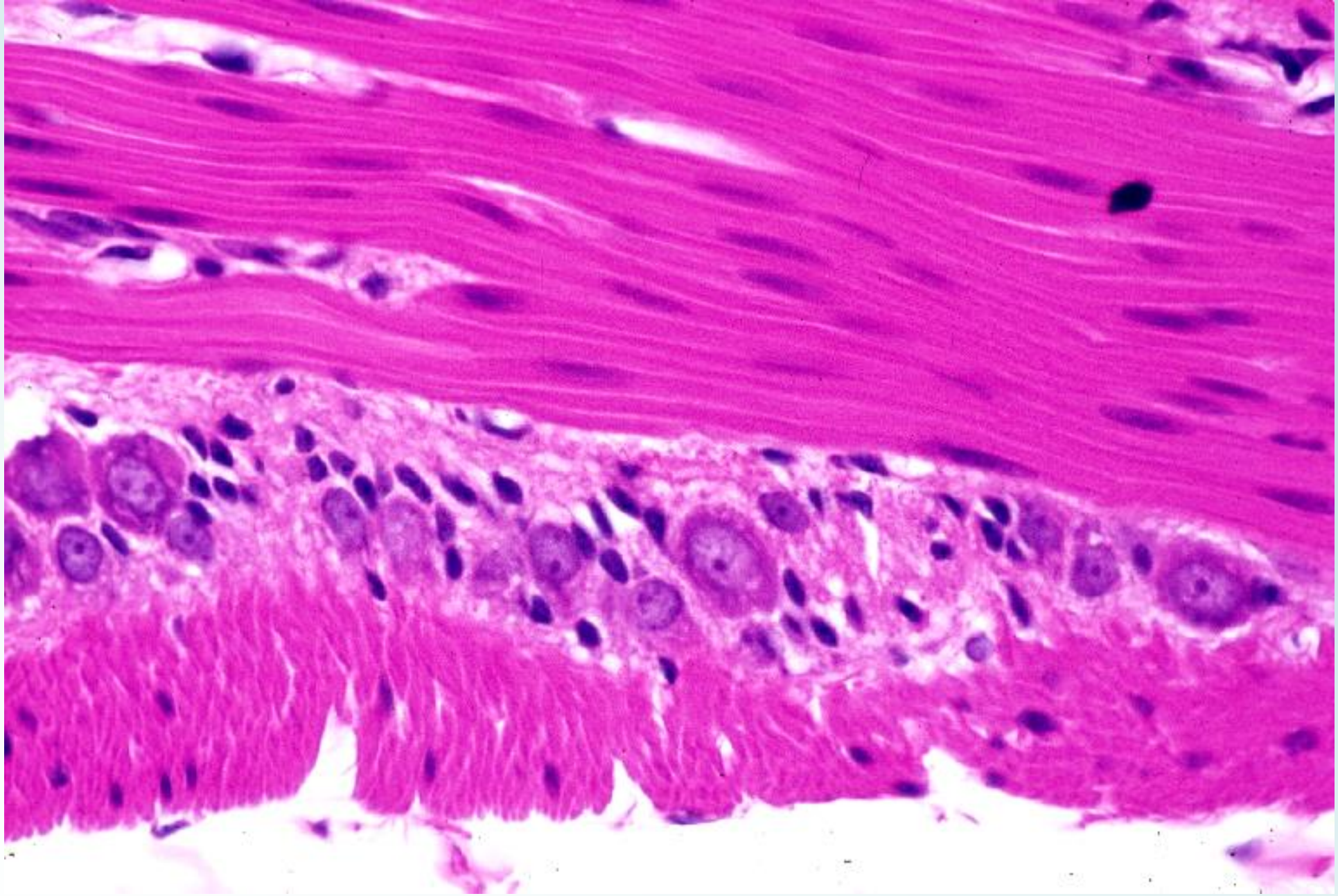
11-21 Ileum, transverse section. General view. Monkey, H-E stain, x 2.5.


11-22 Intestinal villi, ileum. Monkey, H-E stain, x 50.

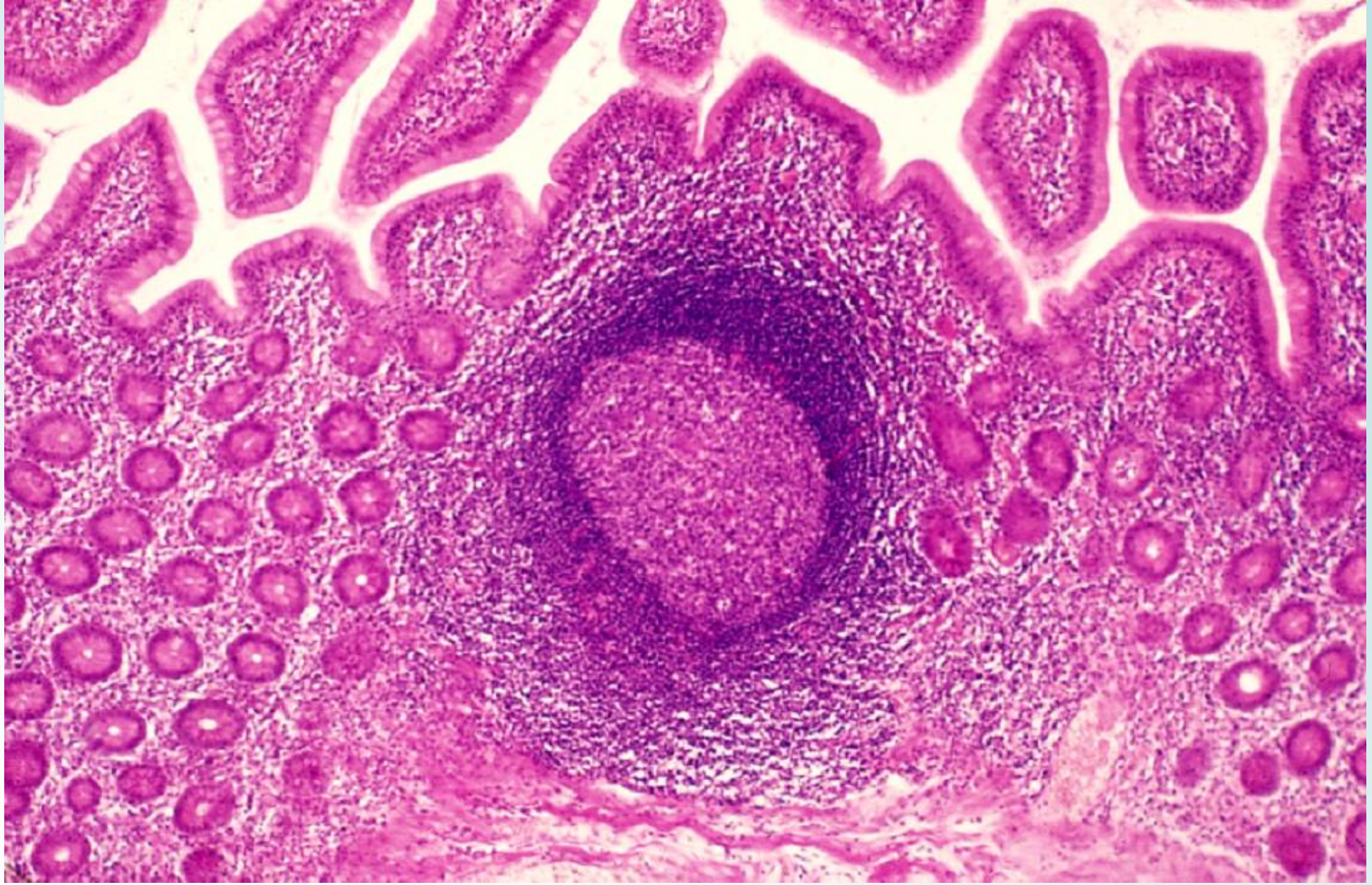

11-23 Intestinal villus, longitudinal section. Monkey, H-E stain, x 130.



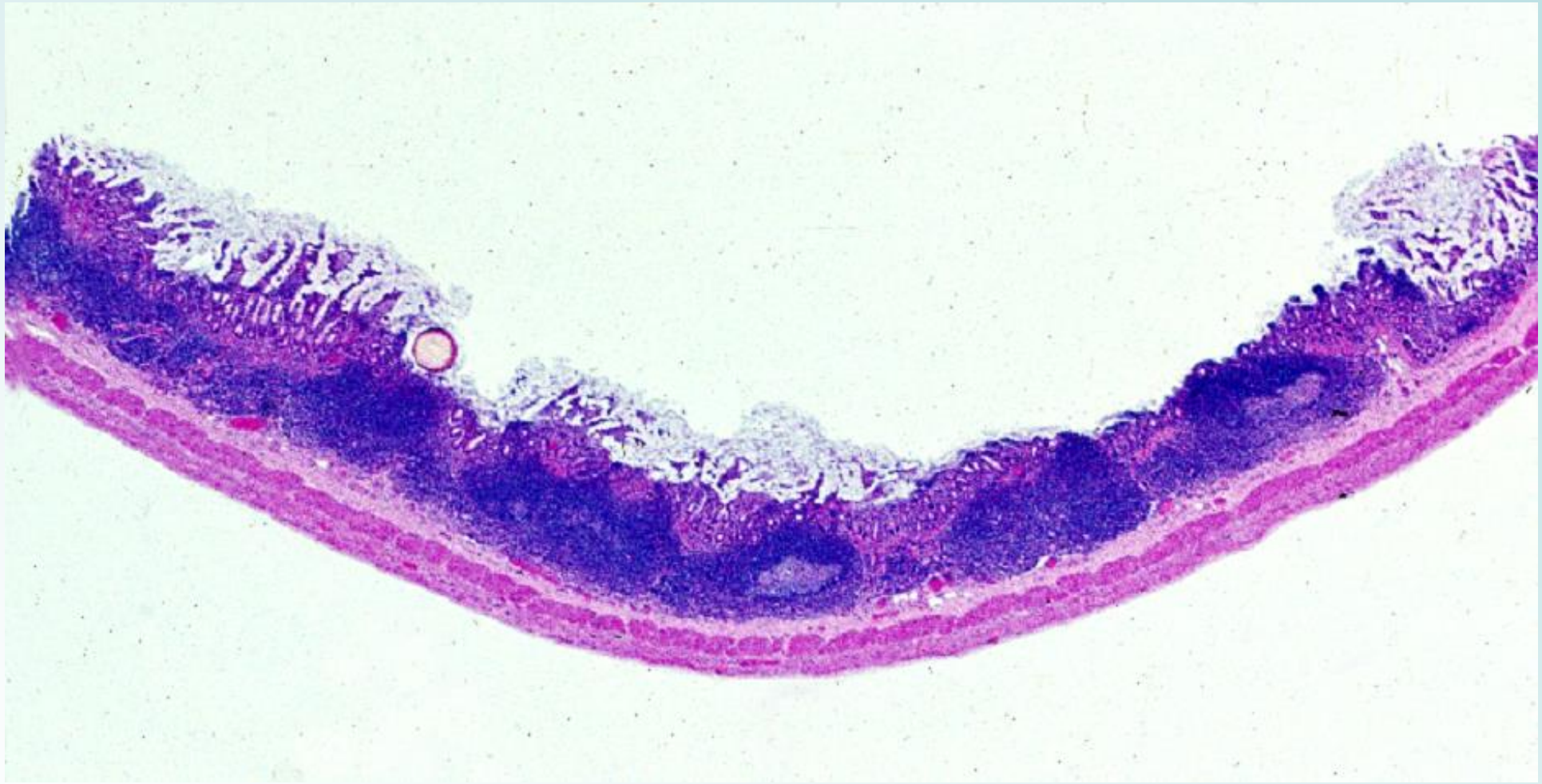
11-24 Meissner's plexus, ileum. Human H-E swtain, x160.



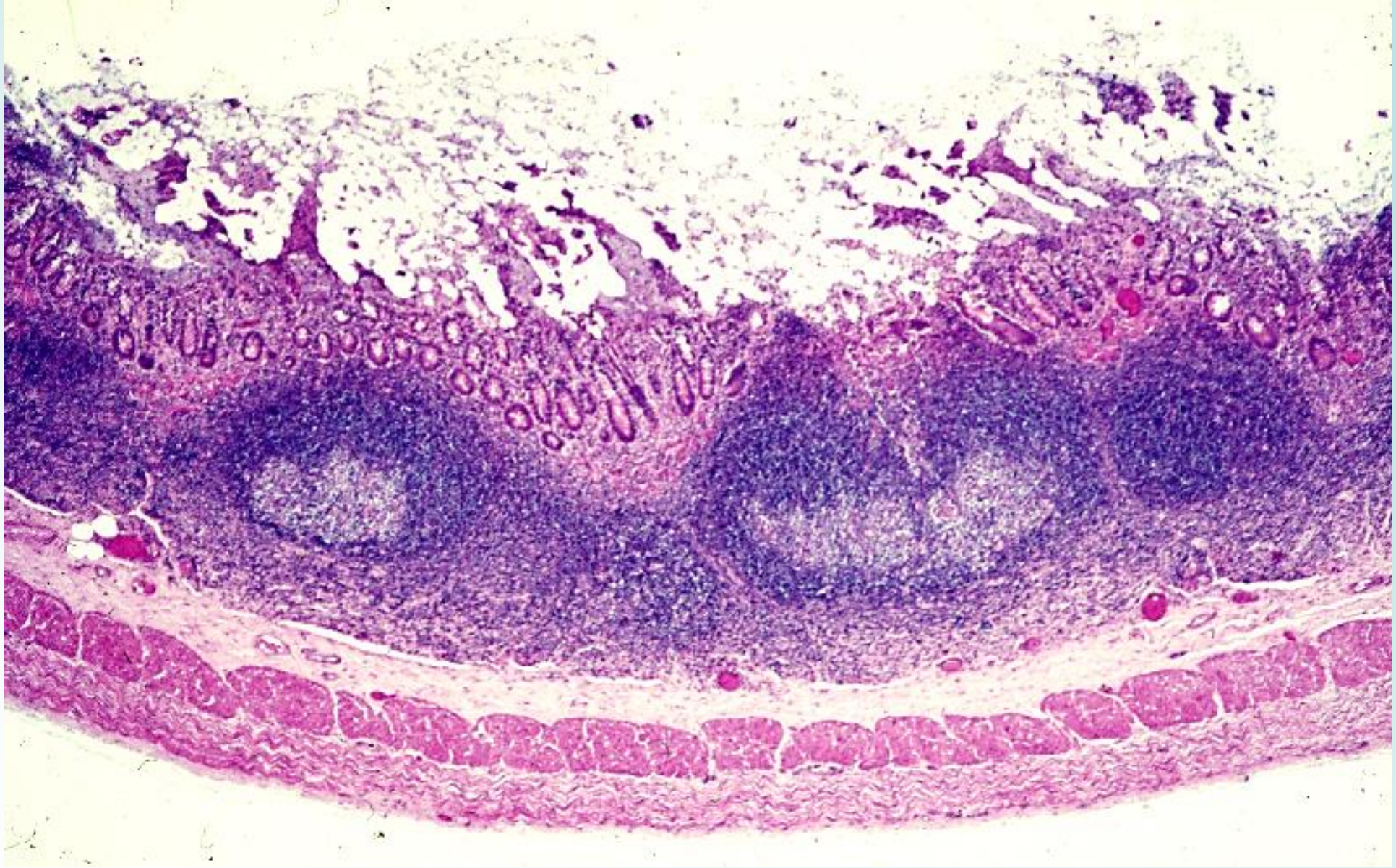
11-25 Auerbach's plexus, ileum. Monkey, H-E stain, x 160.



11-26 Solitary lymphatic nodule. Human jejunum. H-E stain, x 25.

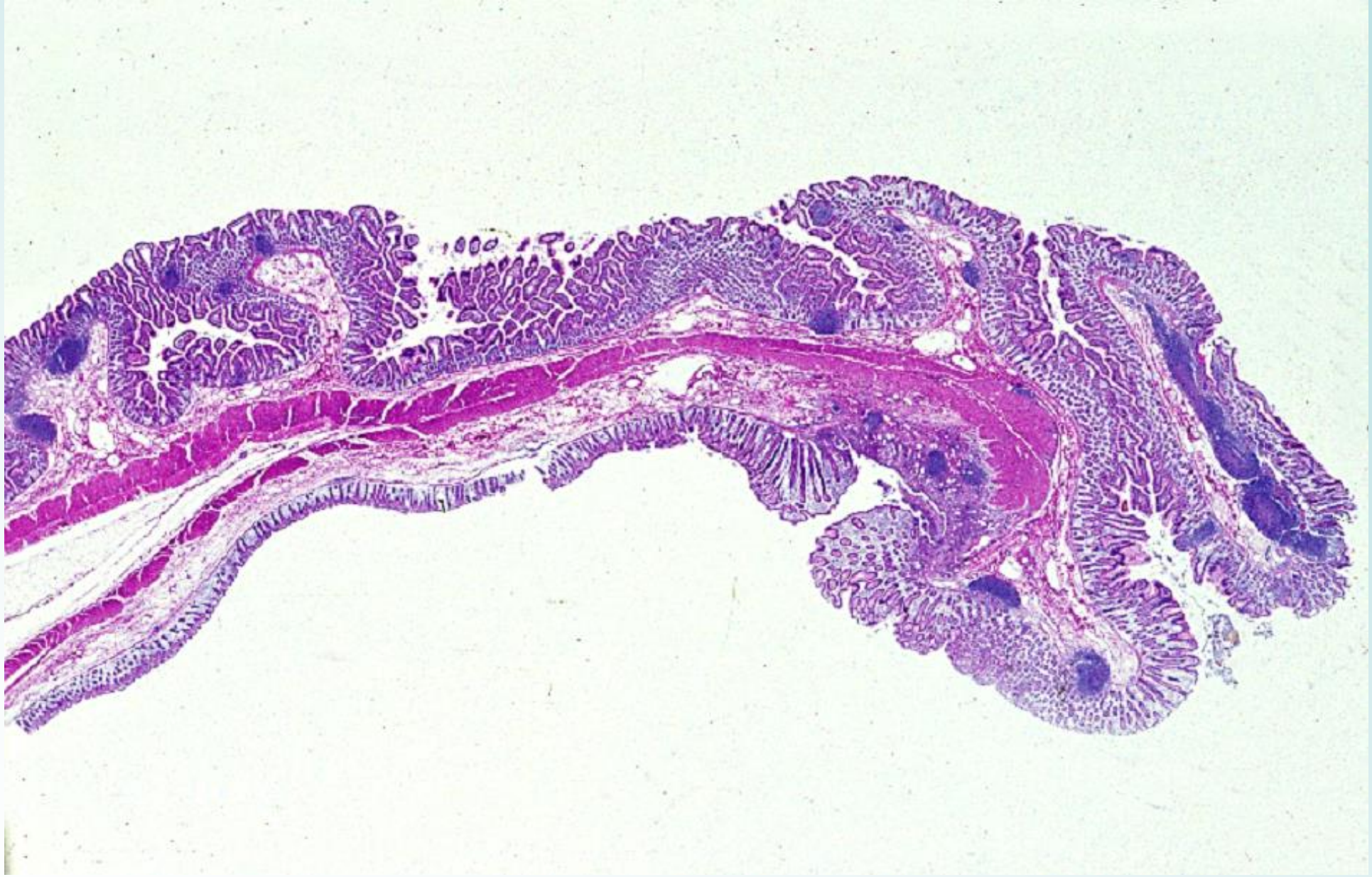


11-27 Aggregated lymphatic nodules 1. Human, H-E stain, x 3.25.

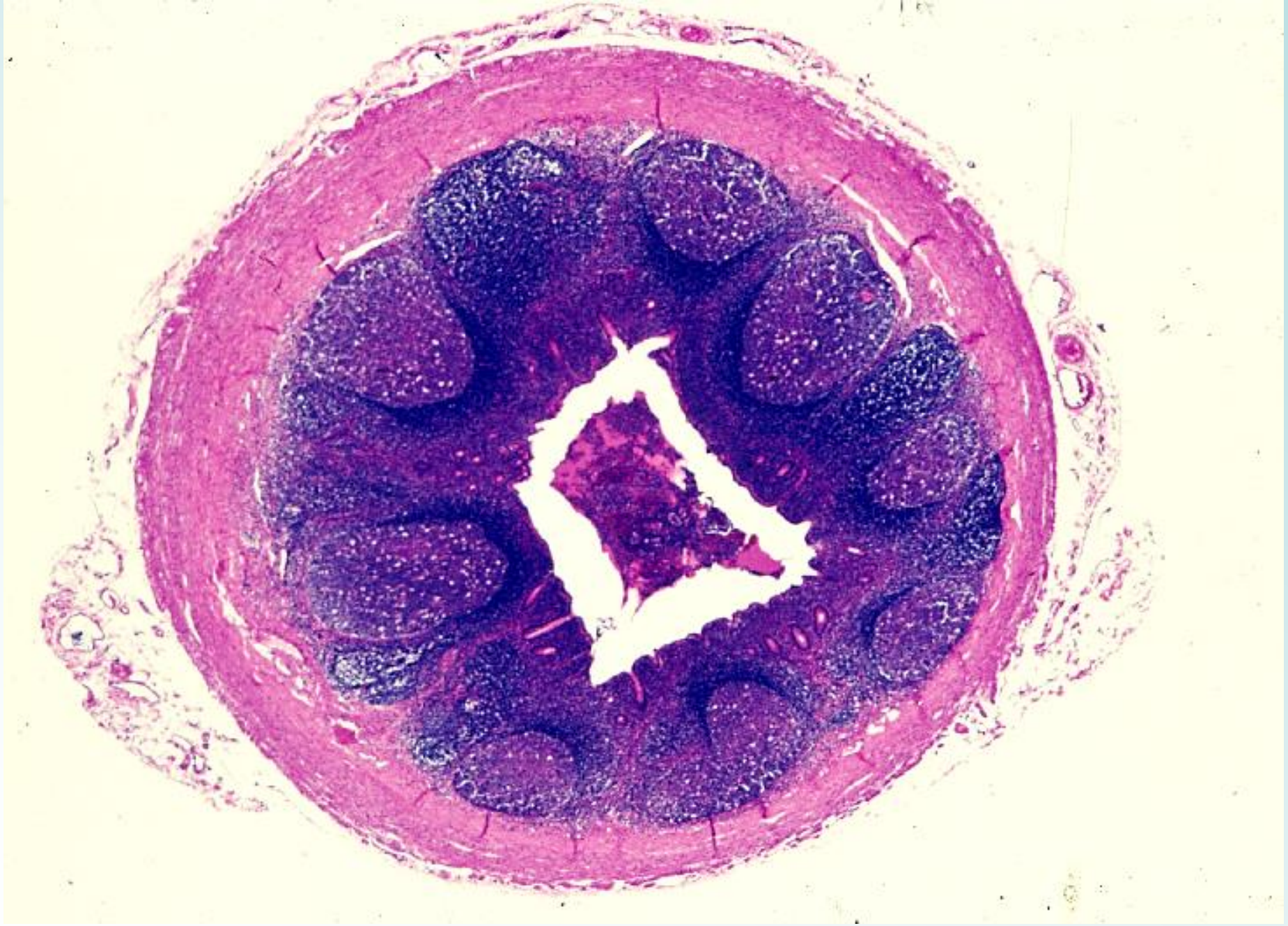


11-28 Aggregated lymphatic nodules 2. Human, H-E stain, x 10.

# 11-002
# Large Intestine

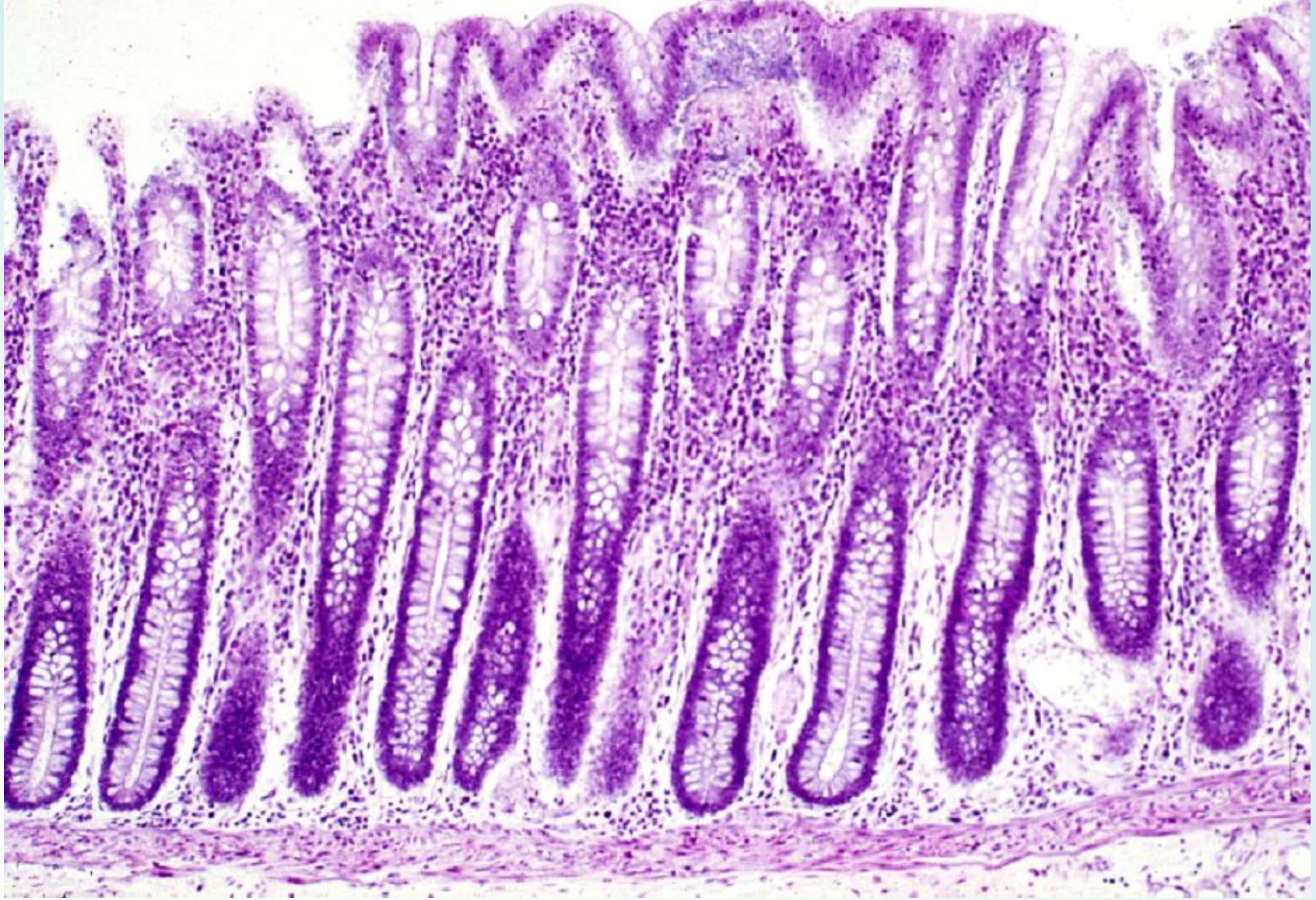


11-29 Ileocecal valve, longitudinal section. Monkey, H-E stain, x 1.6.

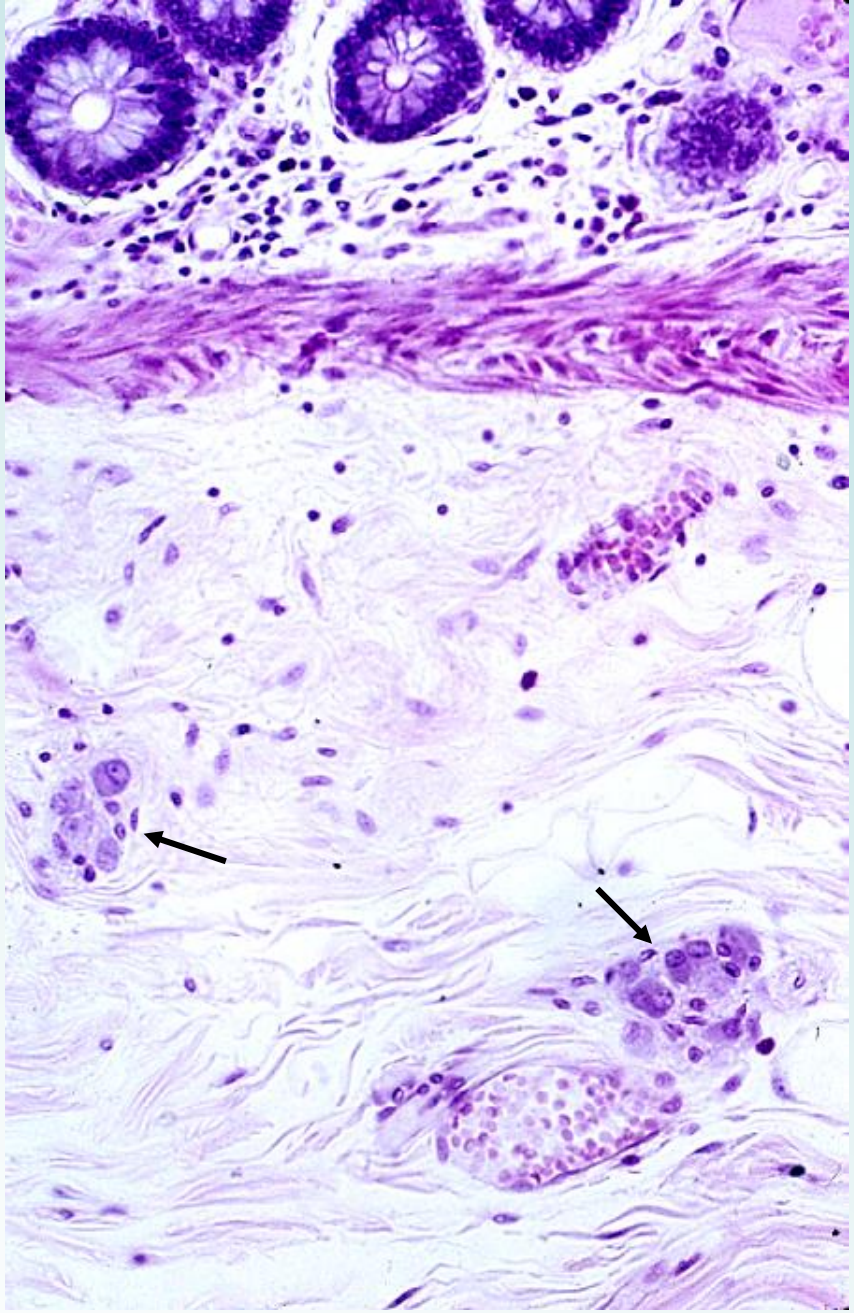


11-30 Appendix vermiformis, transverse section. Human, H-E stain, x 4.0.

11-31 Large intestine, transverse section. Monkey, H-E stain, x 2.5.

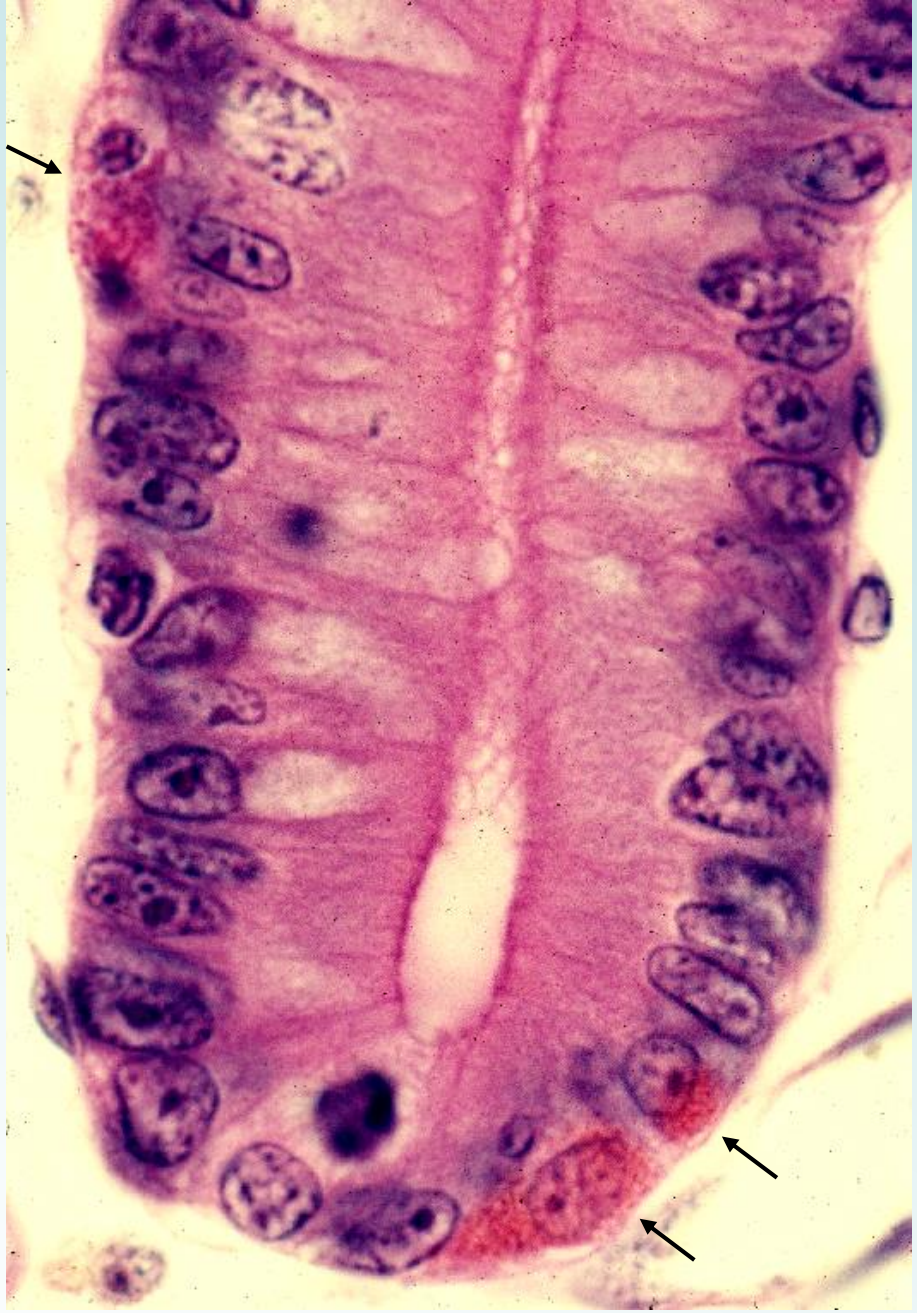


11-32 Mucous membrane of the large intestine, 1. Human, H-E stain. X 25.



11-33 Tela submucosa of the large intestine. Meissner's plexus. Human, H-E stain, x 64.

11-34 Mucous membrane of the large intestine, 2. monkey, H-E stain, x 25.



11-35 Intestinal gland of the large intestine. Monkey, H-E stain, x 400.

11-36 Rect-anal region, longitudinal section. Human, H-E stain, x 0.75.

# 11-000 Digestive System 3

# 11-001 Small Intestines (1/2)

- The pars pylorica of the stomach continues into the intestine, which is as a whole very long tubular organ. Digestion of food that is begun in the stomach is continued in the **small intestine** by enzymes produced in its mucosa and assisted by emulsifying agents and enzymes secreted into the lumen by the liver and pancreas. Little or no absorption of the nutrients takes place in the stomach. This is the principal function of the small intestine, which is 4 to 7 m in length and arbitrarily divided into three successive segments: the duodenum, the jejunum, and the ileum.
- The luminal surface of the small intestine is greatly increased by the formation of grossly visible circular folds, plicae circulares, and by countless finger-like processes of microscopic dimensions, the intestinal villi.
- The **plicae circulares** are permanent crescentic folds involving both the mucosa and submucosa and extending half to two thirds of the way around the circumference of the lumen. They are very predominant in the duodenum and proximal half of the jejunum but in the distal half of the jejunum they gradually diminish in size and number and are seldom found beyond the middle of the ileum.
- The **villi** are outgrowths of the mucous membrane and have a length of 0.5 to 1.5 mm. They cover the entire surface of the mucosa and give it a characteristic velvety appearance. In the duodenum they are broad, life-like structures arranged with their long dimension in the transverse direction. In the ileum they gradually become more finger-like.
- Between the bases of the villi are the openings of innumerable intestinal glands or crypts of Lieberkuhn. These are simple tubes, 320 to 450 $\mu$m long, which penetrate the thickness of the mucous membrane and reach almost to the muscularis mucosae. In the bottom of the glands of Lieberkuhn occur regularly the cells of Paneth. They are pyramidal or columnar in shape and contain numerous coarse apical granules stained deeply red with eosin.

# 11-001 Small Intestines (2/2)

- The epithelium covering the free surface of the mucous membrane is simple columnar. Three types of cells are distinguished: columnar absorptive cells, goblet cells and enteroendocrine cells.
- The absorptive cells are columnar or prismatic and of 20 to 26 $\mu$m in height with a centrally situated, vertically elongated nucleus. The luminal surface is specialized to form a striated border, i.e. microvilli. The bases of the cells rest upon a thin but conspicuous basement membrane, which is firmly attached to the connective tissue fibers of the lamina propria.
- The goblet cells are mucus-secreting unicellular glands scattered irregularly among the cylindrical absorptive cells.
- The enteroendocrine cells are visualized by the fixatives containing potassium dichromate as yellowish orange cells locating at the bottom of the intestinal glands or crypts of Lieberkuhn. These reactions are similar to those of the adrenal medulla. Some of these cells precipitate silver salts in the absence of a reducing agent and are called argentaffin cells. They occur as rather widely scattered individual cells and appear to be minor component of the epithelium, but their number in the human intestine is estimated to be innumerable.
- The epithelium covering the villi continues into the glands. The wall of the crypts is lined with low columnar epithelial cells with basophilic cytoplasm and round nuclei in their basal portion. Among them there are numerous mitosis. Here regeneration takes place, and the new cells moving upward differentiate into goblet cells and into the columnar cells with striated borders.
- The epithelial lining of the intestinal tract is continuously being renewed by proliferation of cells in the crypts, their migration up onto the villi, and exfoliation of effete or dying cells at the villus tips. This process of renewal is referred to as the cell turnover of the epithelium and its duration is the cell turnover time.

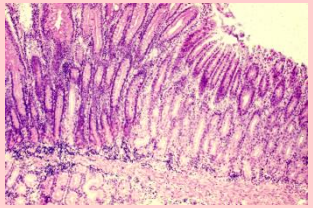
# 11-01 General structure of the digestive system（Scheme）

- The wall of the digestive tube consists of concentrically arranged several layers; they are from inside to outside ① tunica mucosa, ② tela sumucosa, ③ tunica muscularis and ④ tunica serosa.
- The tunica mucosa, mucous membrane, enclosing the lumen of the tube, consists of an epithelium, underlying loose connective tissue, lamina propria, and thin smooth muscle layer, lamina muscularis mucosae. The mucous membrane is enclosed by a layer of the loose connective tissue of coarse collagen fibers, tela submucosa, and then a thick smooth muscle layers, tunica mucosa, consisting of the inner circularly and outer longitudinally oriented smooth muscle layers. The outermost layer is the tunica serosa, i.e. peritoneum, which forms mesenterium at the posterior midline of the tube and connects the tube to the posterior midline of the abdominal cavity.

# 11-02 Pylorus, longitudinal section, 1. Monkey, H-E stain, x 3.0.

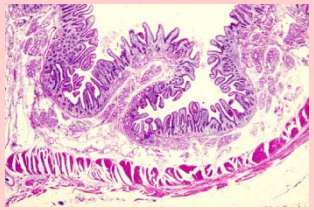
- This figure shows a longitudinal section through the pylorus; the right half of the figure is the pars pylorica of the stomach and the left half, the duodenum. The abrupt transition is indicated by an arrow. In the pars pylorica the mighty musculature, transversely sectioned, in the tela submucosa is the M. sphincter pylori. In the area of the pars pylorica no gland is seen in the tela submucosa whereas in the duodenum there are the duodenal glands occupying the tela submucosa.

# 11-03 Pylorus, longitudinal section, 2. Monkey, H-E stain, x 25.



- Higher magnification of 11-02. In the right half, in the pars pylorica, gastric pits and pyloric glands are seen and in the left half, in the duodenum, intestinal villi and intestinal glands in the mucosa and duodenal glands in the submucosa are seen. The abrupt transition from pars pylorica into the duodenum is indicated by four arrows.

# 11-04 Duodenum, longitudinal section. Human, H-E stain, x 4.



- This specimen was taken from a man who had committed suicide by drinking formalin. According to this peculiar condition the mucous membrane is unusually well preserved. In this figure three plicae circulares are seen, on the surface of which countless intestinal villi protrude into the lumen. In the tela submucosa, beneath the muscularis mucosae, numerous groups of duodenal glands are seen.
- About the tunica muscularis, the musculature of the inner circular layer shows considerable shrinkage.

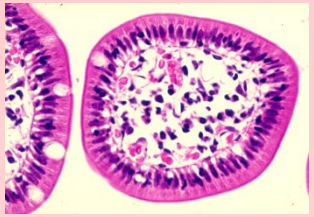
# 11-05 Intestinal villi, longitudinal section 1. Human, H-E stain, x 64.

- This figure shows two longitudinally sectioned intestinal villi. The surface covering epitheliar cells, irregularly intermingled with the goblet cells, and the connective tissue core containing numerous free cells are perfectly preserved. In the axial portion of each villus the central lacteal is perceived ( green arrows ).

# 11-06 Intestinal villus, longitudinal section 2. Human, H-E stain, x 160.

- Higher magnification of the left villus in 11-05. The tall columnar epithelial cells, with distinct striated border on the free surface, attach to the basement membrane firmly with their basal surface. The basal portion of the epitheliar cells becomes slender so that a narrow gap is evident between each cells. Directly beneath the basement membrane there are numerous capillaries. At bottom center of this figure a portion of the central lacteal ( green arrow ) is seen. In the connective tissue, lamina propria, there are numerous free cells.

# 11-07 Intestinal villus, transverse section. Human, H-E stain, x 160.

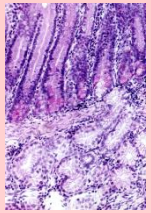


- This is a transverse section of an intestinal villus. The epithelial cells provide the evident striated border and their basal portion becomes slender so that a narrow gap between each cells is conspicuous. Their basal surface attaches firmly to the basement membrane, directly beneath of which there are numerous capillaries containing erythrocytes. At center a transverse section of the central lacteal is seen ( arrow ). In the lamina propria there are numerous free cells.

# 11-08 Intestinal glands and duodenal glands 1. Human, H-E stain, x 25.

- This is to show the intestinal glands in the lamina propria and duodenal glands in the tela submucosa. The intestinal glands or crypts of Lieberkuhn are simple tube beginnig at the bases of the hollow between two villi and penetrating into the lamina propria. They consist of simple columnar epithelial cells with basophilic cytoplasm. In the bottom of the glands there are conspicuous cells containing numerous coarse granules staining deep red with eosin, i.e. the Paneth cells.
- The duodenal glands locate in the submucosa and consist of richly branched and coiled tubules arranged in lobules 0.5 to 1.0 mm in diameter. The ducts penetrate the muscularis mucosae to open into a crypt of Lieberkuhn. The terminal portions consist of lightly pink staining cuboidal or columnar epithelial cells enclosing a wide lumen, so that the glands appear very alike with mucous glands. The secretion is a clear, viscous, and distinctly alkaline fluid. Its principal function is thought to protect the duodenal mucosa against the erosive effects of the acid gastric juice.

# 11-09 Intestinal glands and duodenal glands 2. Human, H-E stain, x 64.

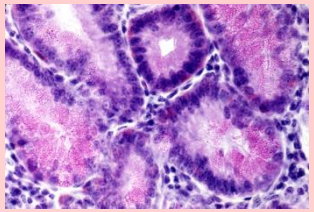


- In the middle of this figures traverses the lamina muscularis mucosae; upper to it densely packed are intestinal glands, at the bottom of which the Paneth cells containing deeply red stainded coarse granules are evident; lower to it, tela submucosa is filled by the duodenal glands. At middle right two ducts of the duodenal glands penetrate the muscularis mucosae.

# 11-10 Intestinal gland, longitudinal section. Monkey, H-E stain, x 400.

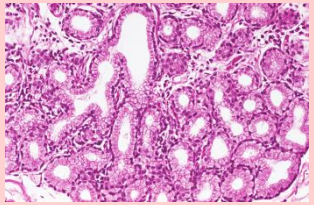
- This is a high power magnification of the basal portion of an intestinal gland. The high columnar epithelial cells enclose the narrow lumen; long elliptic nuclei, locating in the basal portion, arrange perpendicular to the basement membrane. The cytoplasm shows distinct basophilia. Four Paneth cells containing red stained coarse granules are evident. Along the outer surface of the gland five enterochroendocrine cells are recognized ( arrows ). Their granules are fine, locate basal than the nucleus and show the orange hue. At top center a mitotic figure is seen.

# 11-11 Intestinal glands, transverse section. Monkey, H-E stain, x 160.



- In this figure, transverse sections of the bottom of the intestinal gland are densely packed. The coarse granules of the Paneth cells are conspicuous. The enteroendocrine cells are also evidently perceived. The space separating each gland is filled by free cells.

# 11-12 Duodenal gland. Human, H-E stain, x 64.



- This is the same specimen as 11-04. The duodenal glands locate in the submucosa and consist of richly branched and coiled tubules arranged in lobules 0.5 to 1.0 mm in diameter. The ducts penetrate the muscularis mucosae to open into a crypt of Lieberkuhn. The terminal portions consist of lightly pink staining cuboidal or columnar epithelial cells enclosing a wide lumen, so that the glands appear very alike with mucous glands. In this figure at top center is a duct which branches repeatedly constituting the whole lobule.

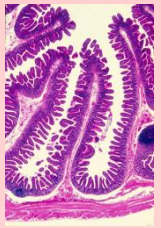
# 11-13 Papilla duodeni major, transverse section. Monkey, Azan stain, x 2.3.

- This is the transverse section of the duodenum through the papilla duodeni major.
- At lower middle, the ductus choledocus causes an elevation on the back wall of the pars descendens of the duodenum, that is papilla duodeni major ( arrow ) and the ductus choledocus opens at the top of its undermost portion. In this figure opening of this duct is clearly seen.

# 11-14 Jejunum, transverse section. H-E stain, x 1.2.

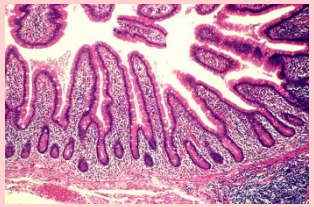
- This is a whole view of the transverse section of human jejunum. This specimen was taken from a man who had committed suicide by drinking formalin. According to this peculiar condition the mucous membrane is unusually well preserved.
- The numerous plicae circulares protrude high into the lumen and from their surface innumerable intestinal villi project into the lumen. The free space of the intestinal lumen appears narrow, through which flows the foods, digested by the enzymes and became liquid. During this the nutrients are absorbed via epithelium into the blood.
- At the left side attaches the mesenterium.

# 11-15 Jejunum, plicae circulares. Human, H-E stain, x 4.



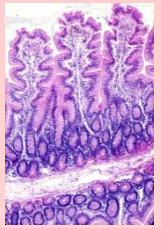
- Three plicae circulares protrude high into the lumen containing tela submucosa as a core. From the surface of them innumerable intestinal villi project into the lumen. Tunica muscularis consists of inner circular and outer longitudinal smooth muscle layers. The outermost layer is tunica serosa, that is peritoneum but difficult perceive.

# 11-16 Jejunum, mucous membrane. Human, H-E stain, x 10.



- At the lower one fourth traverses the lamina muscularis mucosae, upper to that is the mucous membrane. There are numerable intestinal villi and intestinal glands.
- The intestinal villi are finger-like outgrowths of the mucous membrane, having the epithelial covering and a core of loose connective tissue, lamina propria, containing numerous capillaries beneath the epithelium and a straight blind lymphatic tubule, central lacteal, at the axial portion. In the lamina propria a lot of free cells are seen.
- Between the bases of the villi are the openings of the intestinal glands or crypts of Lieberkuhn. These are simple tubes, which penetrate the thickness of the mucous membrane and reach almost to the muscularis mucosae. At the bottom they contain the Paneth cells.
- At lower right corner there is an infiltration of the lymphocytes.

# 11-17 Jejunum, plica circularis. Monkey, H-E stain, x 30.

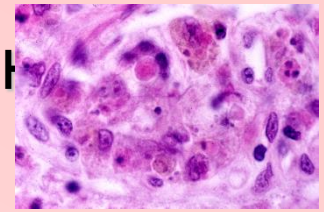


- At the lower one fourth traverses a connective tissue layer between two thin muscle layers. This is the core of a plica circularis. Upper to this muscle layer three intestinal villi and transverse sections of the intestinal glands are seen, in the bottom of which the Paneth cells containing red stained granules are conspicuous. In the middle locating villus a longitudinally sectioned central lacteal is evident. Around the intestinal glands and in the core of villi a lot of free cells are seen. In the young animals intestinal villi shows foliated form.

# 11-18 Intestinal villus, longitudinal section. Monkey, H-E stain, x 64.

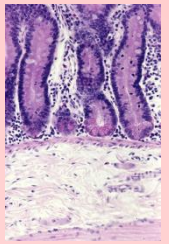
- Higher magnification of the villus locating at center in 11-17. Throughout the whole length of axial portion of this villus penetrates a blind lymphatic tube, the central lacteal, which is attended by a few smooth muscle fibers. Beneath the epithelium a large number of free cells seen, especially at the tip of the villus groups of the macrophages are evident. Higher magnification of this portion will be shown in 11-19.

# 11-19 Macrophages in the lamina propria of an intestinal villus. Monkey, H E stain, x 400.



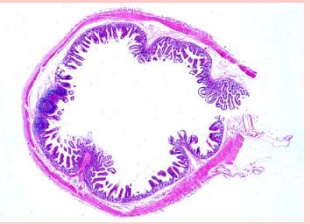
- These are macrophages crowding in the lamina propria at the top of an intestinal villus. Macrophages take in extrinsic alien substances and also intrinsic residues to eliminate from the body. They transform them with enzymes, lysosomes, to harmless substances and keep within the cytoplasm. The macrophages loaded such substances migrate and finally arrive at the tip of the intestinal villi. At the tips of the intestinal villi exfoliation of the effete and dying epithelial cells takes place continuously. With such exfoliation above macrophages are also dropped down into the intestinal cavity and eliminated as a part of feces.
- In this figure macrophages are large and contain much dark brownish substance, some of them contain even erythrocytes and leucocytes.

# 11-20 Intestinal glands and tela submucosa. Monkey, H-E stain, x 64.



- This figure shows the intestinal glands and tela submucosa of monkey jejunum. The intestinal glands consist of tall columnar cells enclosing a narrow lumen. Among the epithelial cells numerous mitotic figures are scattered. At the bottom of the glands the Paneth cells containing red granules are evident. Between the glands there are a lot of free cells. Beneath the bottoms of the glands traverses a thin muscular layer, lamina muscularis mucosae, lower to which is the tela submucosa containing two small plexus of Meissner. The lowermost layer is a part of tunica muscularis, circular muscle layer.

# 11-21 Ileum, transverse section. General view. Monkey, H-E stain, x 2.5

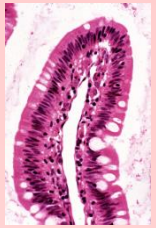


- This figure shows whole view of a transverse section of the ileum. At the right side attaches the mesenterium and at the opposite side the aggregated lymphatic nodules are seen. In the ileum diminish the plicae circulares in size and in number; in this figure only four of them are present. The intestinal villi are also less numerous.

# 11-22 Intestinal villi, ileum. Monkey, H-E stain, x 50.

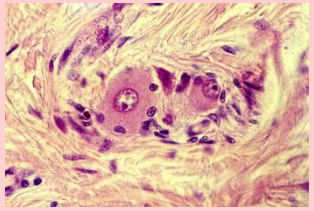
- Here two intestinal villi are longitudinally sectioned, both of which the central lacteal penetrates the axial portion. Among the epithelial cells a number of goblet cells are scattered. As the villi are less numerous, the intestinal glands are also scanty so that the lamina propria is wide and contains numerous free cells.

# 11-23 Intestinal villus, longitudinal section. Monkey, H-E stain, x 130.



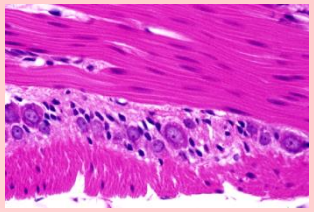
- Higher magnification of 11-22. The central lacteal is here widely opened and its lining endothelial cells are evident. In the lamina propria at the tip of the villus numerous large macrophages are seen. Among the covering tall columnar epithelial cells a lot of goblet cells are scattered.

# 11-24 Meissner's plexus, ileum. Human H-E swtain, x160.



- In the tela mucosa small groups of nerve cells and nerve fibers are scattered. They are called Meissner's plexus. They control the functions of the mucous membrane, especially the functions of the glands. Here a small group of three nerve cells and nerve fibers in the connective tissue is shown.

# 11-25 Auerbach's plexus, ileum. Monkey, H-E stain, x 160.



- In the tunica muscularis, between the circular and the longitudinal muscle layers there are groups of nerve cells which control the motion of the intestine. They are called Auerbach's plexuses. Here a large one consisting of numerous nerve cells is shown.

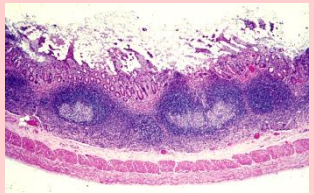
# 11-26 Solitary lymphatic nodule. Human jejunum. H-E stain, x 25.

- The lamina propria of the small intestine contains great numbers of isolated lymphatic nodules, solitary nodules. This figure shows a solitary lymphtic nodule in the human jejunum consisting of a large germinal center and densely surrounding small lymphocytes.

# 11-27 Aggregated lymphatic nodules 1. Human, H-E stain, x 3.25.

- In the ileum, on the wall opposite to the attachment line of the mesentery, there are aggregated lymphatic nodules, Payer's patch, They are grossly recognizable as elongated, oval, slightly thickened areas, 12 to 20 mm long and 8 to 12 mm wide.
- This figure shows a longitudinal section of aggregated lymphatic nodules. The surface epithelium is almost entirely destroyed whereas the aggregated nodules are relatively well preserved.

# 11-28 Aggregated lymphatic nodules 2. Human, H-E stain, x 10.

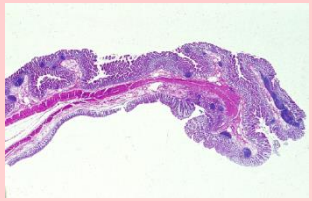


- This is a higher magnification of a part of 11-27. Two nodules have each a large germinal center. The surrounding infilt5ration of small lymphocytes is limited within the lamina propria. Beneath the nodules numerous lymphatics are perceived as fissures. Surface epithelium is almost entirely destroyed.

# 11-002 Large Intestine

- The **large intestine** includes several successive segments: the cecum, the ascending, transverse, and descending colon, the sigmoid colon, the rectum and the anus. At the junction of the cecum and the ascending colon, the ileum joins it on its medial side and the orifice between the two is closed by the ileocecal valve. Projecting from the cecum posteromedial to the ileocecal valve is the vermiform appendix.

# 11-29 Ileocecal valve, longitudinal section. Monkey, H-E stain, x 1.6.



- This figure shows the longitudinal section of the lower lip of the ileocecal valve; the upper side is the ileum and the lower, cecum. On the upper side, numerous intestinal villi cover the surface whereas on the lower side no villi are seen and the surface is smooth. In this figure, the mucous membrane of the ileum covering the upper surface of the valve turns beyond the tip of the valve to the lower surface and abruptly shifts to that of the cecum. The muscle layers of each part are separated in the left half of this figure and unite together in the right half.

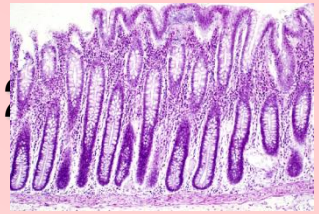
# 11-30 Appendix vermiformis, transverse section. Human, H-E stain, x 4

- The appendix is a blindly ending evagination of the cecum. Its wall is thickened by an extensive development of lymphatic tissue, which forms an continuous layer with many large and small lymphatic nodules. The small lumen often contains masses of dead cells and detritus. The lymphatic tissue of the appendix is similar to that of the tonsils and often shows chronic inflammatory changes.
- Here is shown the transverse section of an human appendix.

# 11-31 Large intestine, transverse section. Monkey, H-E stain, x 2.5.

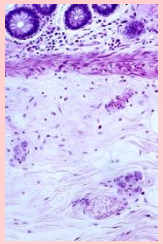
- The mucous membrane of the large intestine does not form folds nor villi so that ithqas a smooth surface, which is lined by simple columnar epithelium with a thin striated border.
- The glands of Lieberkuhn are straight tubules and their length are larger than in the small intestine. They differ from the glands in the small intestine in their greater abundance of goblet cells. At the bottom of the crypts are the usual proliferating , undifferentiated epithelial cells and occasionally enterochomaffin cells. No Paneth' cells occur in the large intestine.
- The structure of the lamina propria is essentially the same as in the small intestine; eosinophilic leucocytes are abundant.
- The tunica muscularis is well developed and consists of inner circular and outer longitudinal layers. The external longitudinal layer differs from the corresponding coat of the mall intestine in that, longitudinally oriented muscle fibers are localized in three thick bands to form the teniae colli.
- This figure shows the general features of the large intestine, colon transversum.At top middle tenia mesenterica is evident. But in the monkey no omentum majue is present, so that differentiation of the tenia omentalis and tenia libera is unable. The tela submucosa is wide and consists of coarse collagenous fibers.

# 11-32 Mucous membrane of the large intestine, 1. Human, H-E stain. X



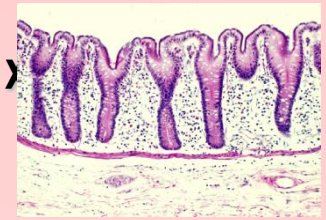
- The lowermost edge is the lamina muscularis mucosae consisting of the smooth muscle fibers. Above this the field is occupied by the crypts of Lieberkuhn, densely parallel arranged one another and perpendicular to the muscularis mucosae. Each crypt is lined by tall columnar epithelial cells, intermingled by a lot of goblet cells. The lamina propria is filled by innumerable free cells.

# 11-33 Tela submucosa of the large intestine. Meissner's plexus. Human, E stain, x 64.



- At about upper one third of the figure traverses the lamina muscularis mucosae, and lower to this is the tela sumucosa, where two small groups of nerve cells, the Meissner's plexus are seen ( arrows ).

# 11-34 Mucous membrane of the large intestine, 2. monkey, H-E stain, × 25.

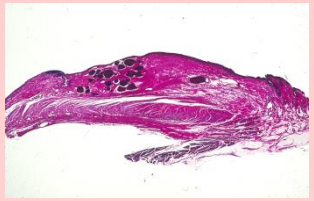


- At about the lower one third of the figure traverses the lamina muscularis mucosae and upper to this is the mucous membrane. Here the arrangement of the intestinal crypts is not dense and lamina propria between them is wide and loosely filled by free cells. At bottoms of the crypts yellowish orange hue is perceived, caused by the presence of enterochromaffin cells. Lower to the lamina muscularis mucosae is tela submucosa, where a group of nerve cells, Meissner's plexus, is evident ( arrow ).

# 11-35 Intestinal gland of the large intestine. Monkey, H-E stain, x 400.

- This is a higher magnification of 11-34. As this specimen was treated with fixative containing the potassium dichromate, the enterochromaffin cells are visualized ( arrows ). In these cells chromaffin fine granules are found basal to the nucleus. At bottom of this gland a mitotic figure is conspicuous.

# 11-36 Rect-anal region, longitudinal section. Human, H-E stain, x 0.75.



- The left two thirds of this figure are the mucous membrane of the rectum and the right one third, the skin of the anus. The rectum opens into the anus; the portion of rectum just before the opening is called the anal canal and here shifts abruptly the simple columnar epithelium into the stratified squamous epithelium; here beneath the epithelium appear the networks of veins of large caliber, i.e. plexus hemoroidalis. The circular muscle layer becomes thick and called M. sphincter ani internus; the longitudinal muscle layer joins with M. levator ani.
- The mucous membrane of the anal canal shifts into the skin of anus and begins the cornification of the epithelium and hairs and sebaceous glands appear.
- This specimen was generously given by Prof. Dr. A. Ichikawa.