• The esophagus is a tubular organ that conveys food from the pharynx to the stomach.

• The stomach is a flat hollow bag with wide lumen, which stores the foods, that are minced and ground by the teeth and mixed with saliva, forwarded through the esophagus. In the stomach they are mixed with stomach juice of strong acidity, secreted from the stomach wall, and prepared for digestion in the following intestine.
The wall of the digestive tube consists of concentrically arranged several layers; they are from inside to outside, ① tunica mucosa, ② tela submucosa, 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 muscularis, consisting of the inner circularly and outer longitudinally oriented smooth muscle layers.

The outermost layer is the tunica serosa, peritoneum, which forms mesenterium at the posterior midline of the tube and connects the tube to the posterior midline of the abdominal cavity.
Esophagus is a tubular organ that conveys food from the pharynx to the stomach. Its wall has a typical concentric four layers, ① mucous membrane, ② tela submucosa, ③ Tunica muscularis and ④ adventitia.

- The mucous membrane consists of epithelium, lamina propria and lamina muscularis mucosae. The epithelium is a stratified squamous epithelium without cornification; lamina propria consists of very loose connective tissue, and lamina muscularis mucosae is composed of mainly longitudinally oriented smooth muscle fiber bundles. In esophagus lamina muscularis mucosae is especially well developed.

- The tela sumucosa is the loose connective tissue occupying wide area and consists of relatively coarse collagen fibers. It contains small mixed glands sparsely. In the connective tissue there are a few small groups of nerve cells and nerve fibers, called Meissner’s plexus, that control the function of the epithelium and glands.

- Tunica muscularis is thick and composed of inner circularly and outer longitudinally oriented muscle layers. In the oral one third of the esophagus, they consist of striated muscle fibers, in the anal one third, smooth muscle fibers, and in the middle one third, of both muscle fibers, intermingled. Between the inner circularly and outer longitudinally oriented muscle layers there are nerve plexus, Auerbach’s plexus, consisting of nerve cells and nerve fibers, that control the function of muscle cells. Auerbach’s plexus are larger
and more conspicuous than Meissner’s plexus.

- Tunica adventitia is the loose connective tissue, constituting the outermost layer of the esophagus, and connects the esophagus to the neighboring structures, namely, trachea and vertebral column.
• This figure shows the general view of human esophagus, transversely sectioned.
• Because of the post mortem contraction of the circular muscle fibers, contour of the lumen becomes star-shaped.
• The epithelium limiting the lumen is the stratified squamous, not cornified. The lamina propria is thin and without the glands; lamina muscularis mucosae is thick and conspicuous, consisting of longitudinally oriented smooth muscle fibers.
• The tela submucosa is wide and consists of loose connective tissue of coarse collagen fibers. In this area there are small mixed glands, but not numerous in human. In this area small groups of nerve cells and fibers are scattered; they are called Meissner’s plexus.
• Tunica muscularis consists of two muscle fiber layers: inner circular and outer longitudinal; they are striated muscle fibers in the oral one third of the esophagus, smooth muscle fibers in the anal one third, and mixture of both types in the middle one third. Between these layers there are small groups of nerve cells and fibers, innervating these musculature, called Auerbach’s plexus.
• The outermost layer of the esophagus is wrapped by loose connective tissue, by which the esophagus is connected to the trachea, in front, and vertebral column, backward. This connective tissue is called adventitia.
• This specimen was generously given by Prof. A. Ichikawa, Yokohama Municipal Medical School.
• This specimen was taken from a cadaver which was fixed by infusion of 10% formalin so that capillaries in the lamina propria are all empty.
• The epithelium is thick stratified squamous without cornification and lamina muscularis mucosae consisting of longitudinally oriented smooth muscle fibers is very conspicuous.
• The tela submucosa is wide and two small mixed glands, gll. esophageae, are seen.
• The musculature, inner circular and outer longitudinal, is thick and consists of both smooth and striated muscle fibers.
• This is a longitudinal section of human esophagus. The epithelium is thick stratified squamous without cornification; at the center beneath the epithelium, crossing the lamina muscularis mucosae, there is a duct of esophageal glands, that locates just above the lamina muscularis mucosae. The right gland is densely infiltrated by lymphocytes. The musculature is very thick and the inner circular layer consists of both smooth and striated muscle fibers, whereas outer longitudinal layer, of exclusively striated muscle fibers.
Higher magnification of 10-04. At center an excretory duct consisting of stratified squamous epithelium is seen. The esophageal glands are of mixed type and locate in the tela submucosa.
This is the tunica muscularis of monkey esophagus, fixed with SUSA fixative. The inner circular layer consists of smooth muscle fibers whereas outer longitudinal layer consists of both smooth and striated muscle fibers. Between the two muscle layers two groups of nerve cells are conspicuous; they are the Auerbach’s plexus.
• Higher magnification of 10-06. The Auerbach’s plexus consists of several nerve cells and bundles of nerve fibers. In this specimen the cytoplasmic basophilia of the nerve cells is evident.
• The stomach is an organ which stores food and digests it. In the human stomach the solid food is reduced to a fluid by virtue of the contraction of its muscular wall and the admixture of food with the secretions of the glands of its mucous membrane.
• The opening from the esophagus into the stomach is called the cardia.
• This figure shows a longitudinal section of the transition from the esophagus to the stomach; the upper portion of this figure is mostly esophagus and only the lower edge of the figure is covered by the gastric mucosa. The arched clefts at the center are the esophageal lumen and at its lowermost right part, indicated by an arrow, the esophageal epithelium shifts abruptly to the gastric epithelium.
• Higher magnification of 10-08.
• The right half of the field is the stratified squamous epithelium of the esophagus and the left half is the simple columnar epithelium of the stomach. The abrupt transition of the epithelium is evident.
• This figure shows the abrupt transition of the epithelium, from the stratified squamous to the simple columnar, clearly. In the esophagus no glands are seen in the lamina propria, whereas in the stomach numerous tubular glands, cardiac glands, are in the lamina propria.
• The arrow indicates the abrupt transition from the stratified squamous to the simple columnar epithelium.
• The cardiac glands are distributed in the narrow area surrounding the cardia. They are short tubular glands with tortuous course, so that in sections they appear as groups of transversely sectioned round lumens, that are enclosed by the simple cuboidal epithelium. The appearance of this gland is alike to the mucous gland.
• This is a general view of the wall of the stomach body (fundus) from a man who had committed suicide by drinking formalin.

• The wall consists of mucous membrane, tela submucosa, tunica muscularis and tunica serosa. The mucous membrane is thick and appears dark reddish violet. Tela sumucosa is a loose connective tissue of coarse collagen fibers and contains numerous blood vessels of large caliber. Tunica muscularis consists of three layers of smooth muscle fibers, oblique, circular and longitudinal, but their identification is difficult on each section. Tunica serosa is the peritoneum itself: simple squamous epithelium underlain with small amount of loose connective tissue.

• As this section is relatively thick, structural details of the mucous membrane is not clear. Compare with 10-13.
This is a perpendicular section through the mucous membrane; about the half thickness of it is occupied by a multitude of the gastric (fundus) glands. The surface epithelium is simple tall columnar in shape and sinks deeply into the lamina propria to form innumerable tubular invaginations, gastric pits, from the bottom of that start the fundus glands and attain to the lamina muscularis mucosae. Fundus glands are long tubular glands with narrow lumen and consists of three kinds of acinar cells.

- The lower edge of this figure is the lamina muscularis mucosae.
- This specimen was cut thin, about 5μm in thickness, without tunica muscularis.
This is a very thin section so that the fine structure of the gastric mucous membrane is well discernible. The surface epithelium, deep gastric pits and long tubular glands opening into the bottom of the gastric pits and very loose connective tissue underlying these structures, lamina propria, are all clearly recognized.

The lower middle portion of this figure is shown in 10-24 at higher magnification.
• The surface epithelium is tall columnar in shape, whose apical portion is filled with mucous substance and nucleus is pressed to the basement membrane. This epithelium sinks deeply into the lamina propria to form the gastric pits. Beneath the epithelium and around the pits is filled with the loose connective tissue, lamina propria, containing numerous capillaries and small blood vessels and a number of free cells.
The apical portion of the epithelial cells is filled with mucous substance and the nuclei locate near the basement membrane, beneath which numerous capillaries are seen. The lamina propria is very loose connective tissue containing free cells.
The supranuclear portion of the epithelial cells on the free surface is entirely occupied by granules of a peculiar type of mucigen, which are only visualized by mucicarmine or PAS reaction. In this specimen, stained by mucicarmine, red stained fine granules filling the apical portion of the epithelial cells are evident.

This specimen was made by Prof. Dr. S. Miki.
This specimen was taken from a cadaver three hours post mortem. The surface epithelium and that of the gastric pits are almost destroyed by the post mortem autolysis, but the fundus glands are relatively well preserved.

The fundus glands are simple, less branched tubular glands with very narrow lumen and consist of three kinds of glandular cells. These glands are closely packed together and oriented perpendicular to the surface of the mucosa. They open, from one to several, through a slight constriction or neck into the bottom of each gastric pit. They extend through its entire thickness of 0.3 to 1.5 mm and their diameter is 30 to 50 \( \mu \)m. The blind ends are slightly thickened and coiled and sometimes divide into two or three branches and reach almost to the lamina muscularis mucosae. Each of them is separated by a few loose connective tissue of the lamina propria.

In this figure, the upper one third is the degenerated residue of the surface epithelium and that of the gastric pits, the lower two thirds are the densely packed fundus glands and the bottom edge is the lamina muscularis mucosae.

Figures 10-19 to 10-22 are higher magnifications of this specimen.
• This is the higher magnification of 10-18, showing the neck of the glands. At top there are several bottoms of the gastric pits, into that open the fundus glands. Beneath these follow the upper half of the glands consisting of mucous neck cells and parietal cells that are stained deep red. Each gland is separated by a few loose connective tissue, lamina propria. At lower most region of this figure appear the chief cells with violet cytoplasm.
• This figure is the lower continuation of 10-19. In the upper one fourth of this figure there are still mucous neck cells, whereas in the lower two thirds the glands consist of mainly chief cells and a few parietal cells. The bottom edge is the lamina muscularis mucosae.
• This is the higher magnification of 10-19. In this region the glands consist of mucous neck cells and parietal cells.

• The mucous neck cells, secreting mucus, are relatively few in number and lodged between the parietal cells. They appear to be deformed by neighboring cells and tend to be irregular in shape, some having a wide base and narrow apex, others a broad apex and narrow base. The cytoplasm appears colorless and transparent. The nuclei, dark blue stained, are at the base of cells and are often somewhat flattened.

• The parietal cells, secreting hydrochloric acid, whose cytoplasm stains deeply red with eosin, are large spherical or pyramidal in shape and occupy a peripheral position with their tapering apical ends. Sometimes they bulge on the outer surface of the glands. Each of them contains a single large round nucleus, dark blue stained, but sometimes two or even more nuclei are present in one cell.

• In this figure the lumen of the glands is relatively wide and both side of that form a line the mucous neck cells and the parietal cells. In the lamina propria, separating each gland, there are smooth muscle fiber, oriented perpendicular.
• Higher magnification of 10-20. In this figure the narrow lumen appears evidently and the gland itself consists mainly of the chief cells, among that a few parietal cells are scattered. The chief cells are columnar in shape and their nuclei are round and locate near the basement membrane. The cytoplasm stains violet but in usual sections no secretion granules are recognized. In the lamina propria numerous free cells are seen.
• This is another specimen than 10-19. In this case mucous neck cells between parietal cells are conspicuous.
Higher magnification of 10-14. Because of the good fixation and the thinness of the section fine structures of the fundus glands are well observed. The cytoplasm of the chief cells shows basophilic stainability very well and in the parietal cells the intracellular secretory canaliculi are clearly recognized (arrows).
• This specimen was treated with a fixative containing the potassium dichromate so that the enterochromaffin cells are visualized. In this figure three enterochromaffin cells are seen (arrows).
This specimen was also treated with a fixative containing the potassium dichromate. The cytoplasm of the chief cells shows evident basophilia and filled with granules. A deep red stained large cell locating at bottom right is the parietal cell, which shows the intracellular secretory canaliculi in the supranuclear region. Enterochromaffin cells are seen next to this parietal cell and at upper left edge of the gland (arrows). A thick band along the left side of the gland is a sooth muscle fiber bundle in the lamina propria.
• This is a longitudinal section of human pyloric region. The boundary between the fundus and pars pylorica is sometimes not clear but in this specimen it is easily identified. In this figure the right three fifths contain the fundus glands whereas left two fifths the pyloric glands. The boundary is indicated with an arrow.
This is the mucous membrane of the pars pylorica. Into the bottom of the gastric pits open the pyloric glands that are short tortuous tubular glands, very alike to the cardiac glands. The lower one third of this figure is occupied by smooth muscle fiber bundles of lamina muscularis mucosae.
In this specimen, deep gastric pits and into their bottom opening pyloric glands are seen. The pyloric glands are short tortuous tubular glands with relatively wide lumen. In the lamina propria numerous free cells are seen. The lowermost region of this field traverse the smooth muscle fiber bundles of the lamina muscularis mucosae.
This is to show the mucous membrane and glands in stomach and three different regions of the intestine.