02-00 Epithelium and Glands

02 Epithelium and Glands
Menu 1/2

02-00. Epithelium and Glands

02-001. Epithelium

02-01. Simple squamous epithelium 1. Serosa of human spleen, H-E stain, x 400.

02-02. Simple squamous epithelium 2. Serosa of human spleen, M-G stain, x 400.

02-03. Simple squamous epithelium 3. Mesenterium of frog, silver impregnation, x 160.

02-04. Simple cuboidal epithelium 1. Collecting tubule of human kidney, longitudinal section, Mallory-Crossmon stain, x 400.

02-05. Simple cuboidal epithelium 2. Collecting tubule of human kidney, transverse section, Mallory-Crossmon stain, x 400.

02-06. Simple cuboidal epithelium 3. Collecting tubule of monkey kidney, M-G stain, x 160.

02-07. Simple cuboidal epithelium 4. Pigment epithelium of bovine retina, not stained, x 160.

02-08. Simple squamous and simple columnar epithelia. Human kidney, M-G stain, x 160.

02-09. Simple columnar epithelium 1. Monkey gallbladder, H-E stain, x 160.

02-10. Simple columnar epithelium 2. Human jejunum, H-E stain, x 400.

02-11. Pseudostratified ciliated columunar epithelium 1. Human nasal cavity, H-E stain, x 160.

02-12. Pseudostratified ciliated columunar epithelium 2. Human trachea, Azan stain, x 160.

02-13. Pseudostratified ciliated columunar epithelium 3. Human nasal cavity, H-E stain, x 250.

02-14. Stratified columnar epithelium. Human conjunctiva, H-E stain, x 250.

02-15. Stratified squamous epithelium 1. Human tongue, H-E stain, x 66.

02-16. Stratified squamous epithelium 2. Human tongue, H-E stain, x 160.

02-17. Stratified squamous epithelium, papilla. Human tongue, silver impregnation, x 160.

02-18. Stratified squamous epithelium, intercellular bridges. Human tongue, H-E stain, x 250.

02-19. Stratified squamous epithelium. Human cornea, not keratinized, H-E stain, x 160.

02-20. Stratified squamous epithelium with keratinization. Human thumb-tip, H-Estain, x 64.

02-21. Stratified squamous epithelium with keratinization 2. Human palm, H-E stain, x 25.

02-22. Transitional epithelium 1. Human urinary bladder, H-E stain, x 64.

02-23. Transitional epithelium 2. Human urinary bladder, H-E stain, x160.

02-24. Transitional epithelium 3. Human urinary bladder, H-E stain, x 200.

02 Epithelium and Glands
Menu 2/2

02-002. Glands

02-25. Unicellular gland. Human intestinal epithelium, H-E stain, x 400.

02-26. Multicellular intraepitheliar gland. Human nasal mucosa, H-E stain, x 100.

02-27. Tubular glands. Human gastric glands, H-E stain, x 160.

02-28. Alveolar glands. Human duodenal glands, H-E stain, x 25.

02-29. Serous glands 1. Human lingual gland, H-E stain, x 64.

02-30. Serous glands 2. Human submandibular gland. H-E stain, x 250.

02-31. Serous gland 3. Rabbit, Heidenhain' iron-hematoxylin stain, x 250.

02-32. Mucous gland 1.Monkey, H-E stain, x 64.

02-33. Mucous gland 2. Monkey, H-E stain, x 160.

02-34. Mixed gland 1. Cat tracheal gland, Azan stain, x 63.

02-35. Mixed gland 2. Cat tracheal gland, Azan stain, x 160.

02-36. Mixed gland 3. Dumilunes. Cat tracheal gland, Azan stain, x 160.

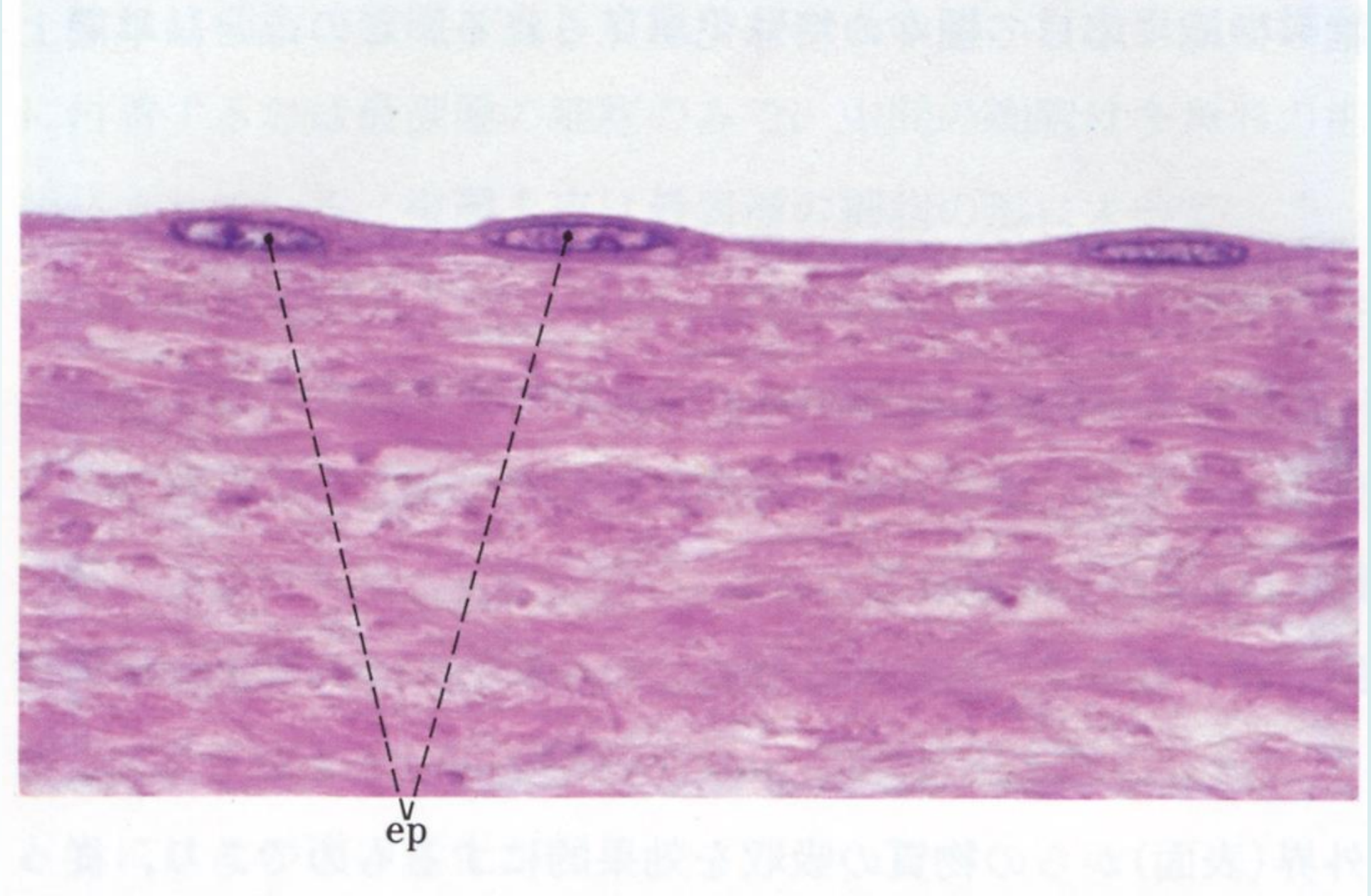
02-37. Apocrine gland. Human, H-E stain, x 100.

02-38. Apocrine gland 2. Human axillar gland. H-E stain, x 66.

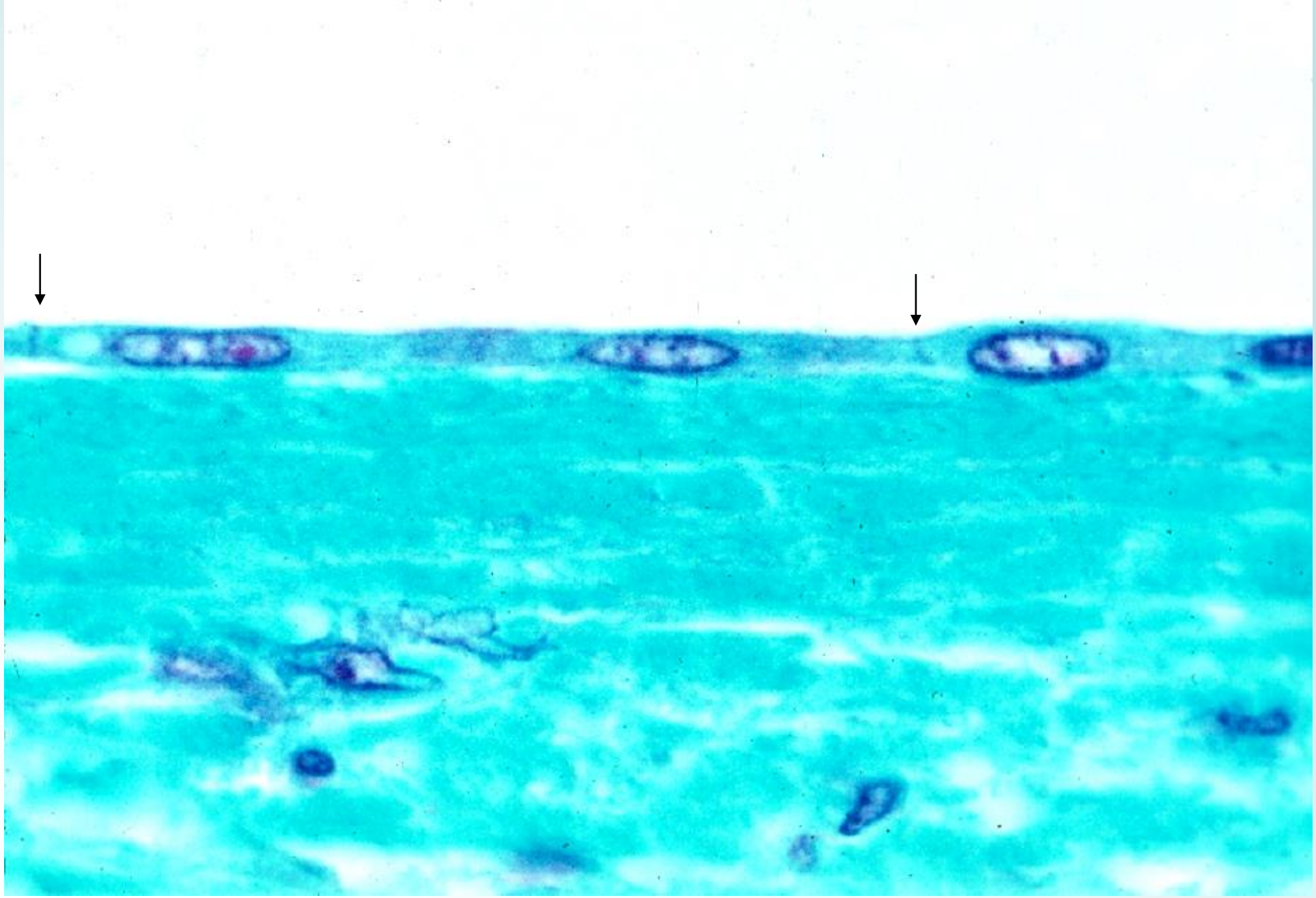
02-39. Holocrine gland 1. Human Meibom gland, H-E stain, x 100.

02-40. Holocrine gland 2. Human sebaceous glands of the scalp, H-E stain, x 30.

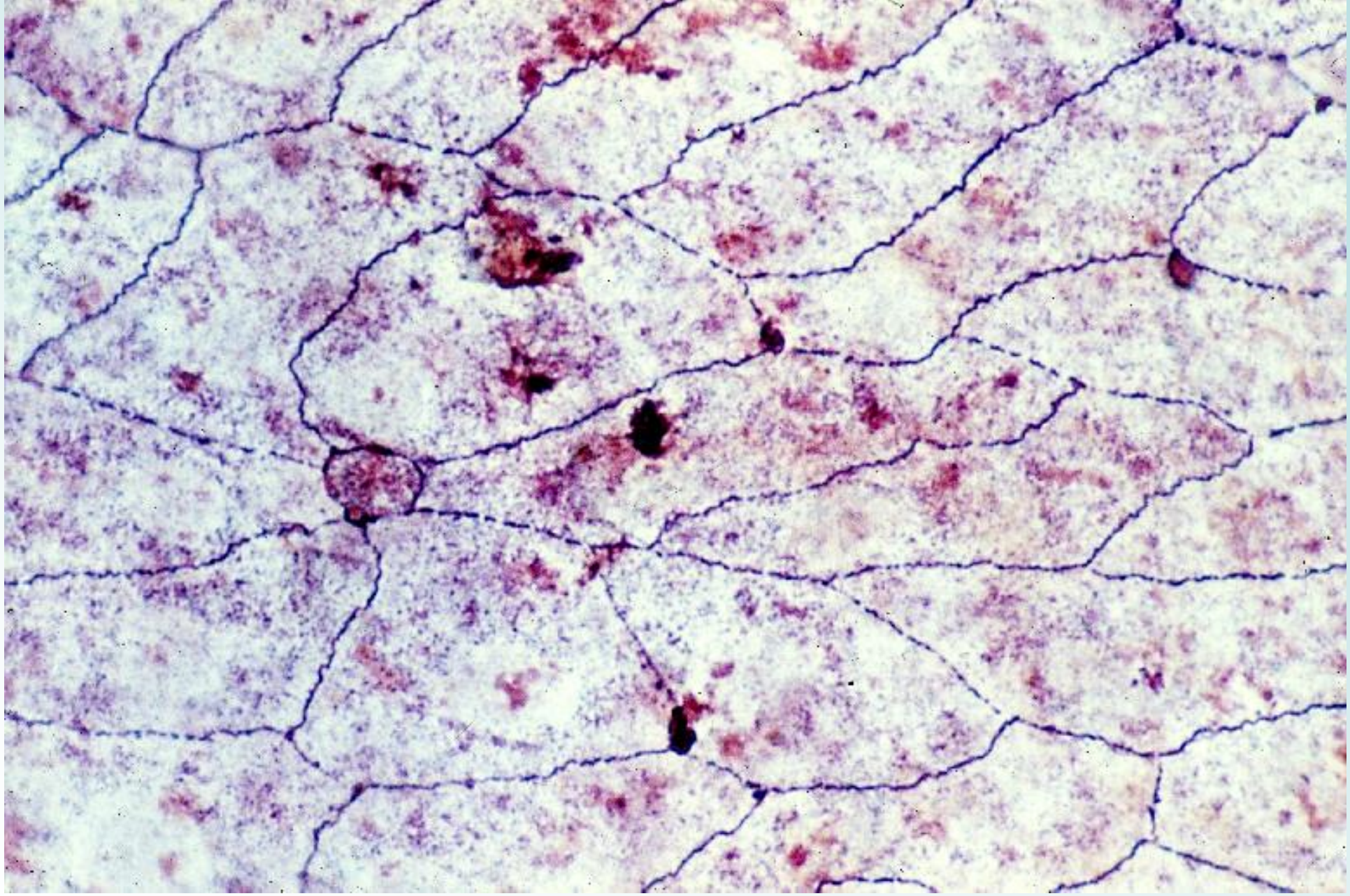
02-001
Epithelium



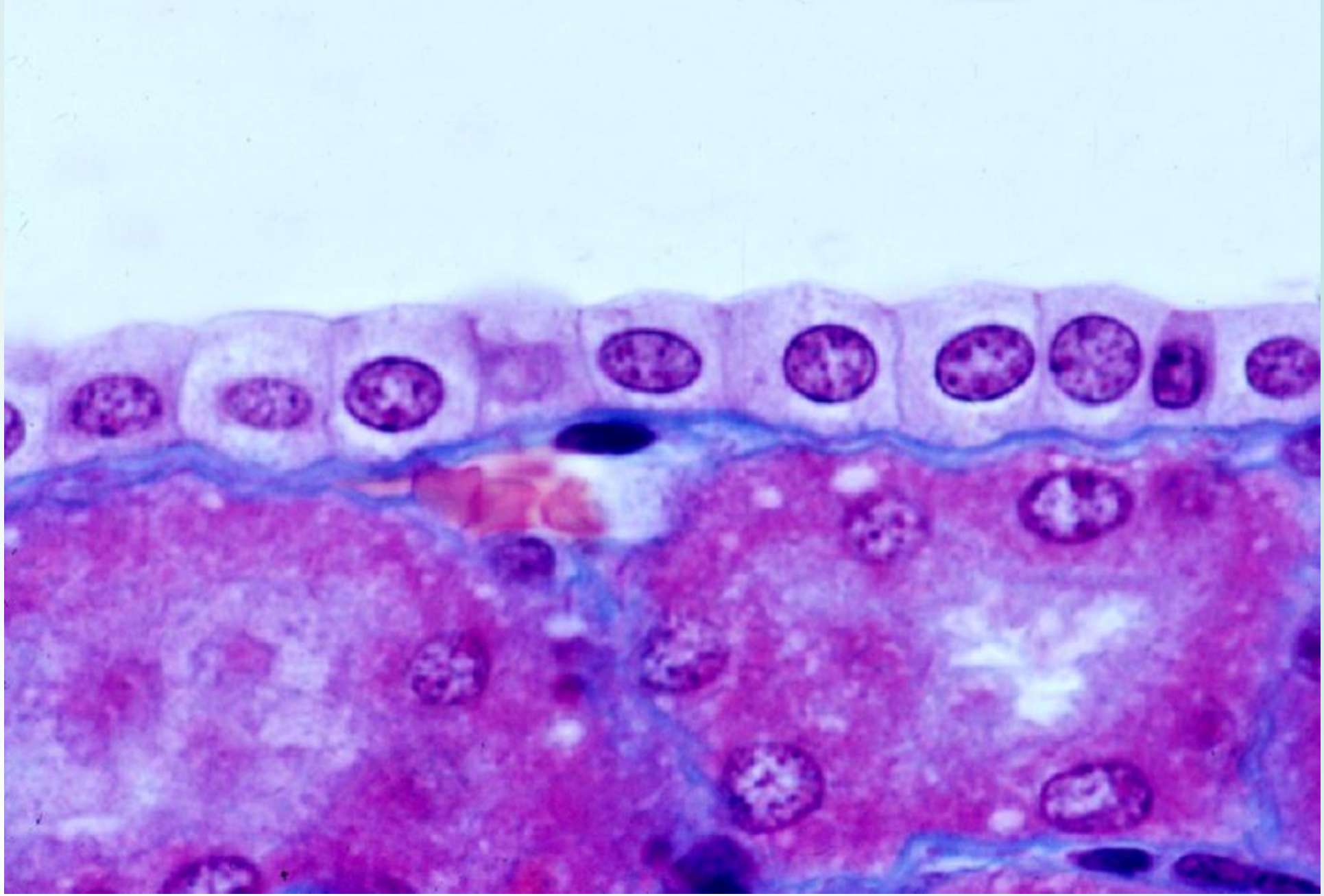
02-01 Simple squamous epithelium 1. Serosa of human spleen, H-E stain, x 400.



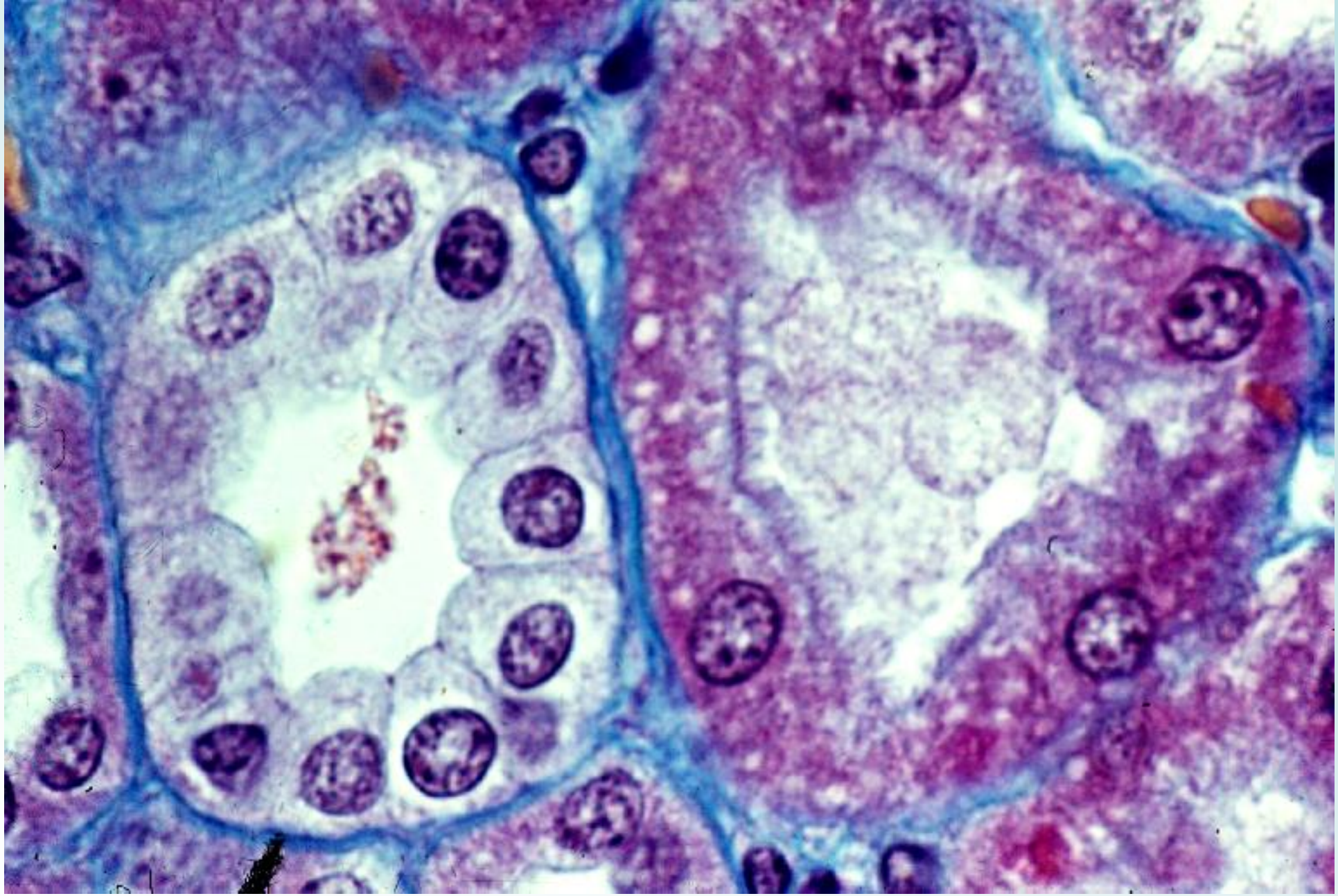
02-02 Simple squamous epithelium 2. Serosa of human spleen, M-G stain, x 400.



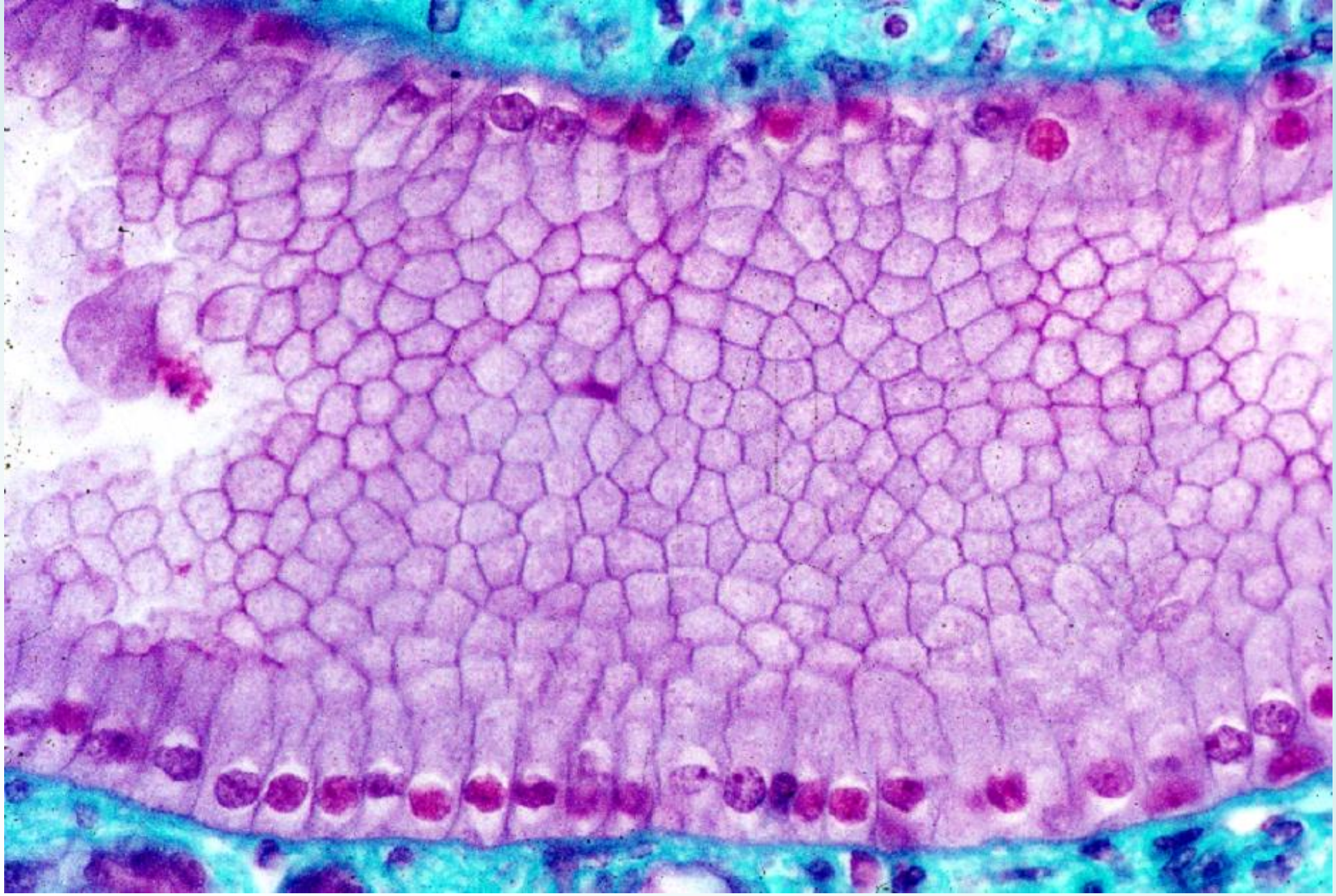
02-03 Simple squamous epithelium 3. Mesenterium of frog, silver impregnation, x 160.



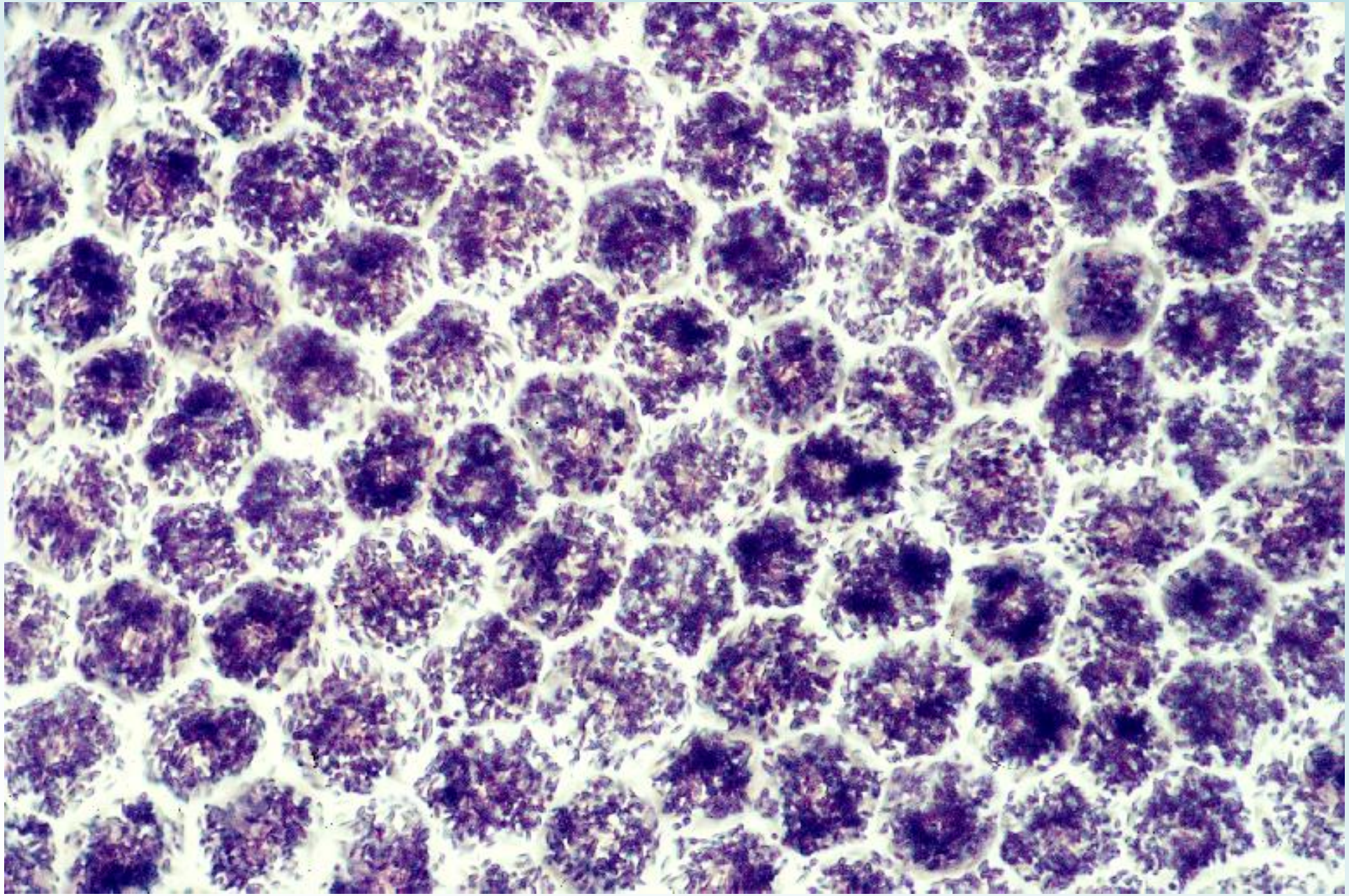
02-04 Simple cuboidal epithelium 1. Collecting tubule of human kidney, longitudinal section, Mallory-Crossmon stain, x 400.



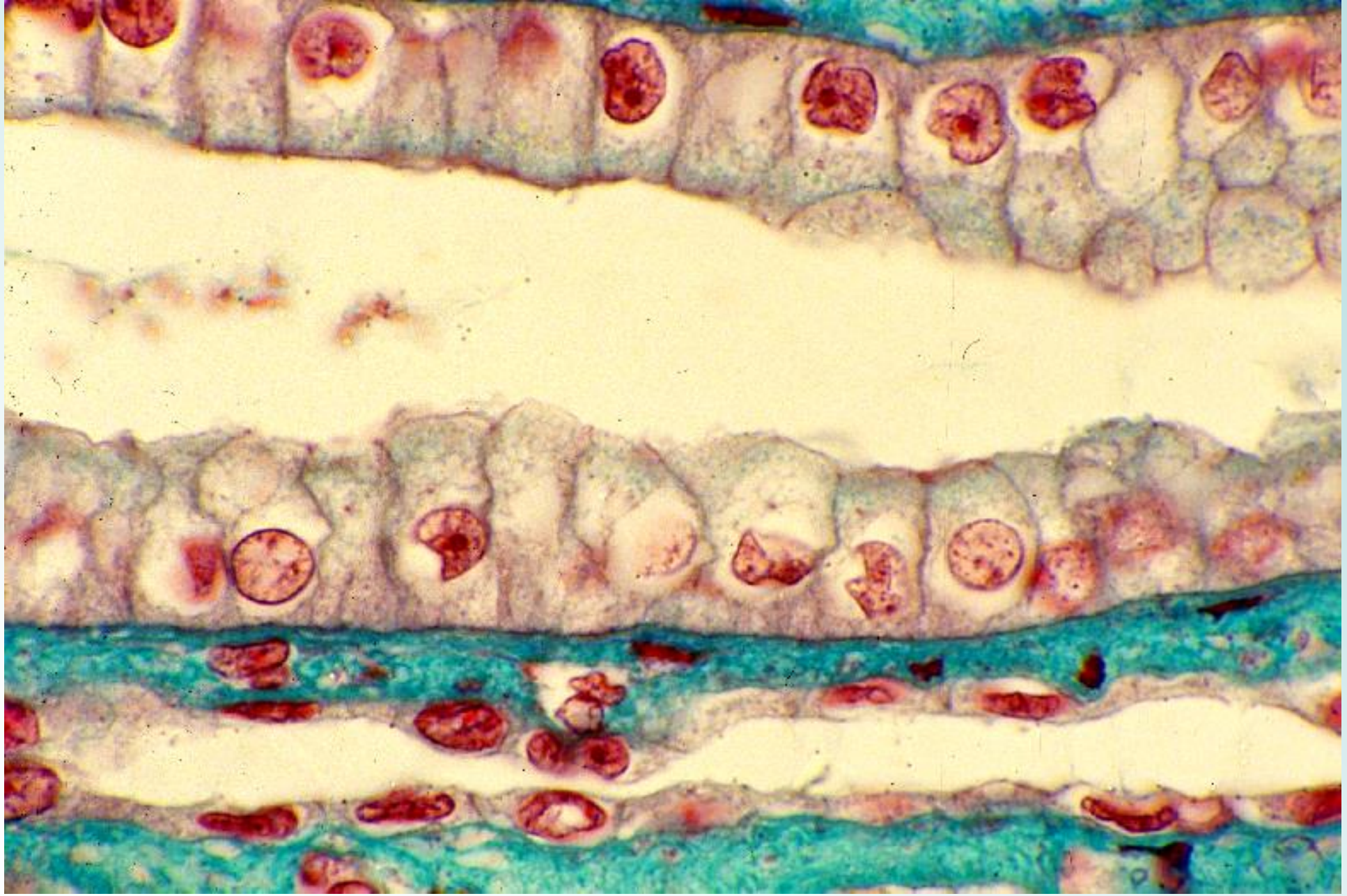
02-05 Simple cuboidal epithelium 2. Collecting tubule of human kidney, transverse section, Mallory-Crossmon stain, x 400.



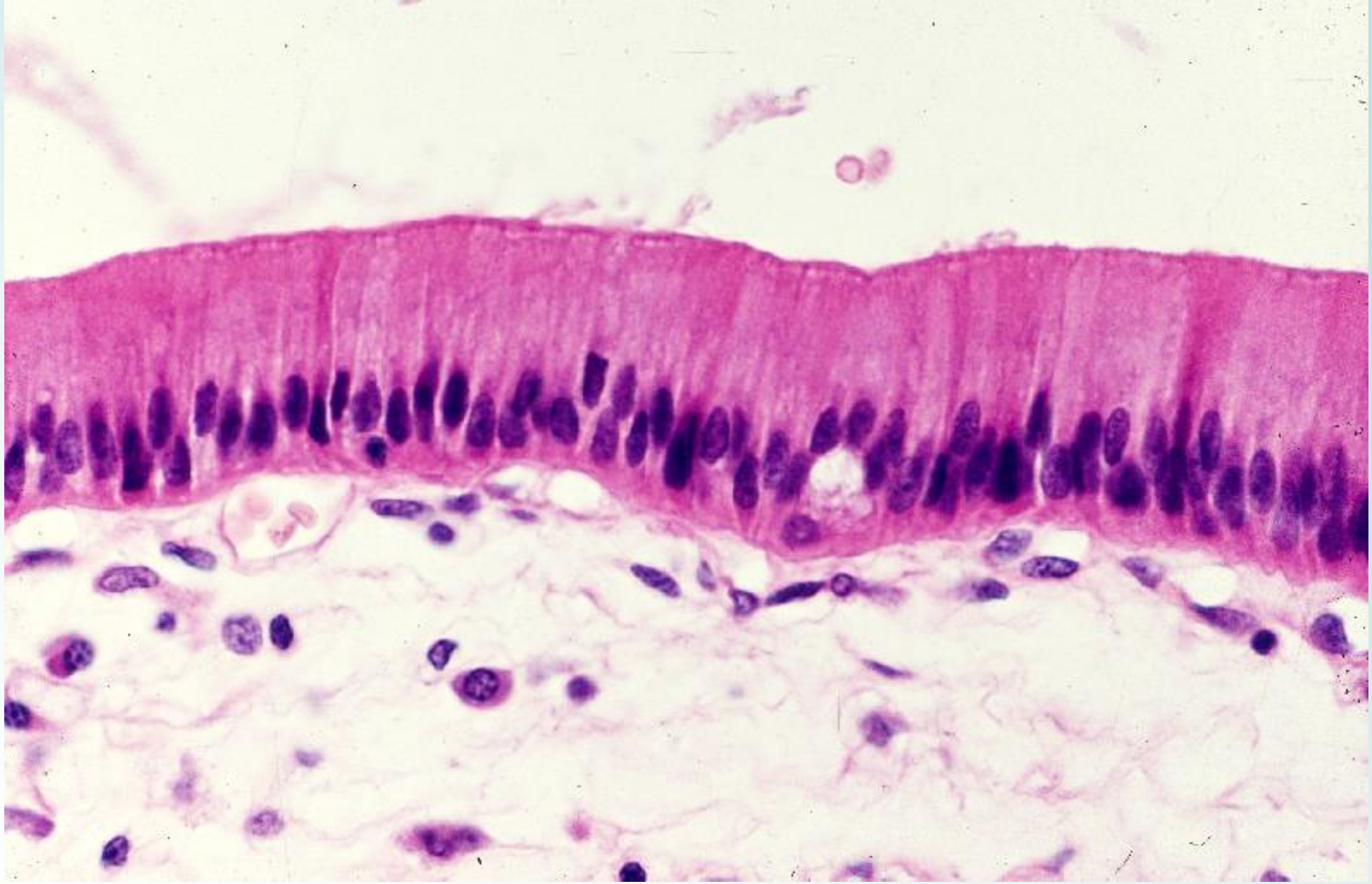
02-06 Simple cuboidal epithelium 3. Collecting tubule of monkey kidney, M-G stain, x 160.



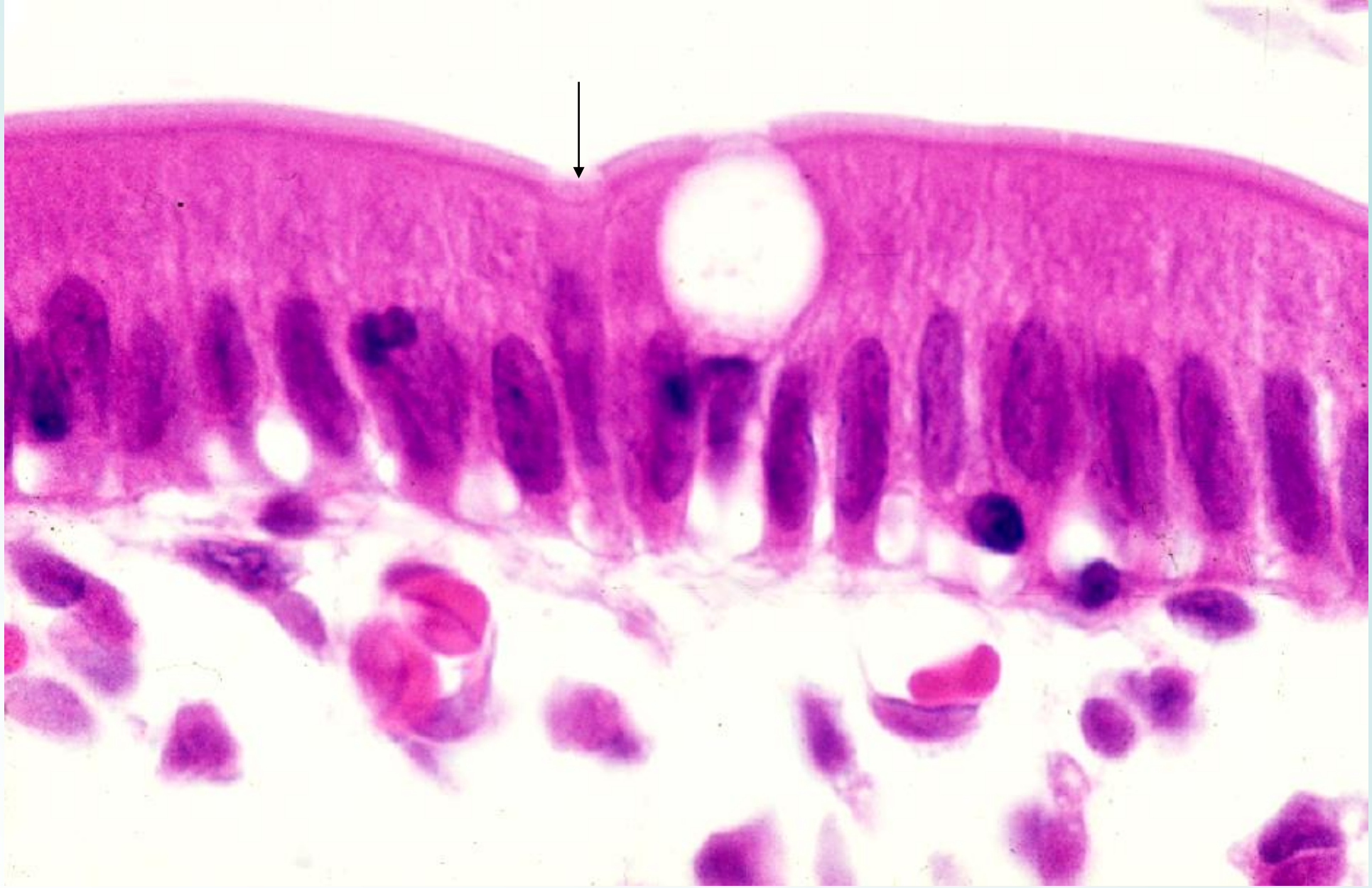
02-07 Simple cuboidal epithelium 4. Pigment epithelium of bovine retina, not stained, x 160.



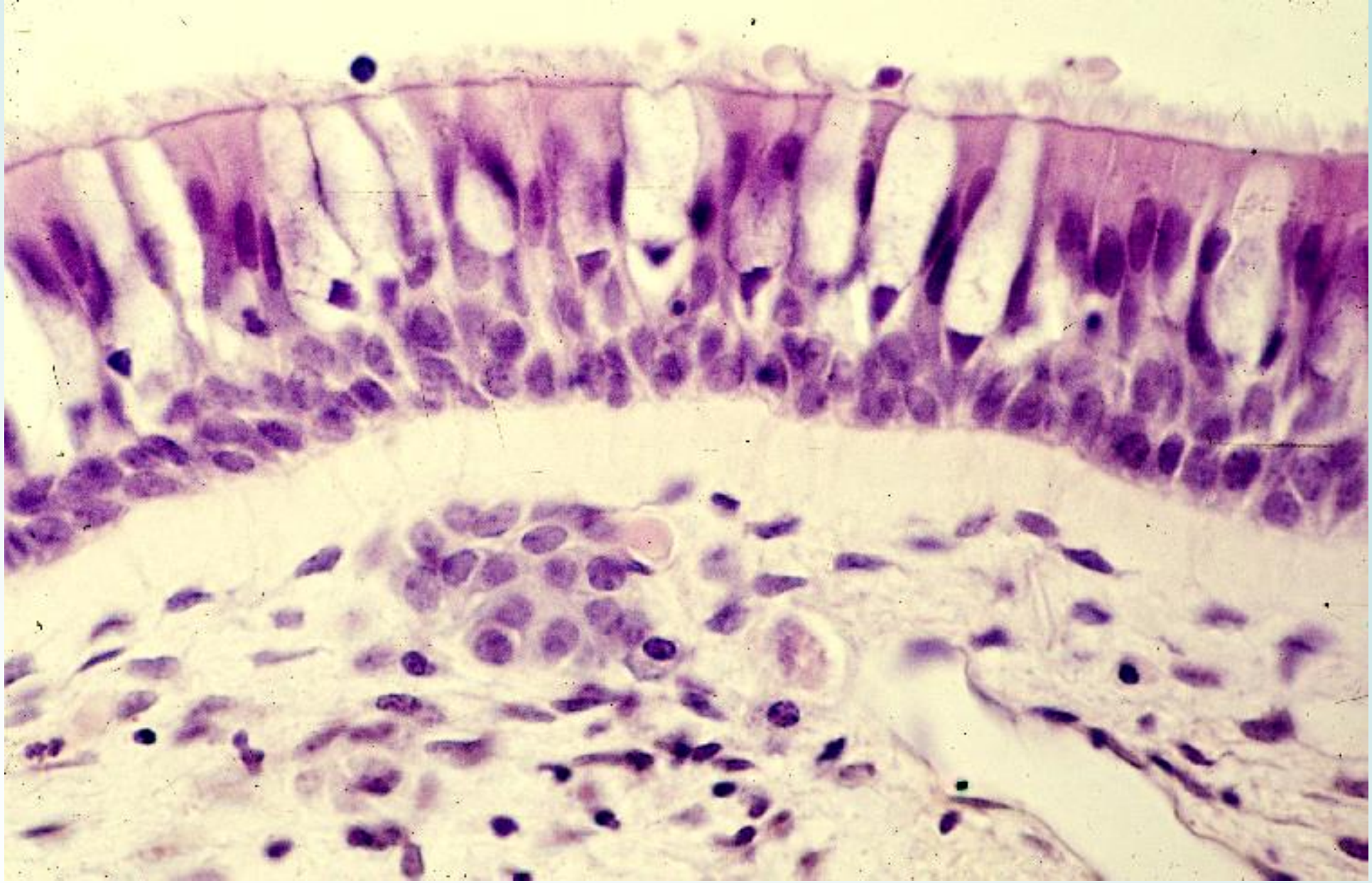
02-08 Simple squamous and simple columnar epithelia. Human kidney, M-G stain, x 160.



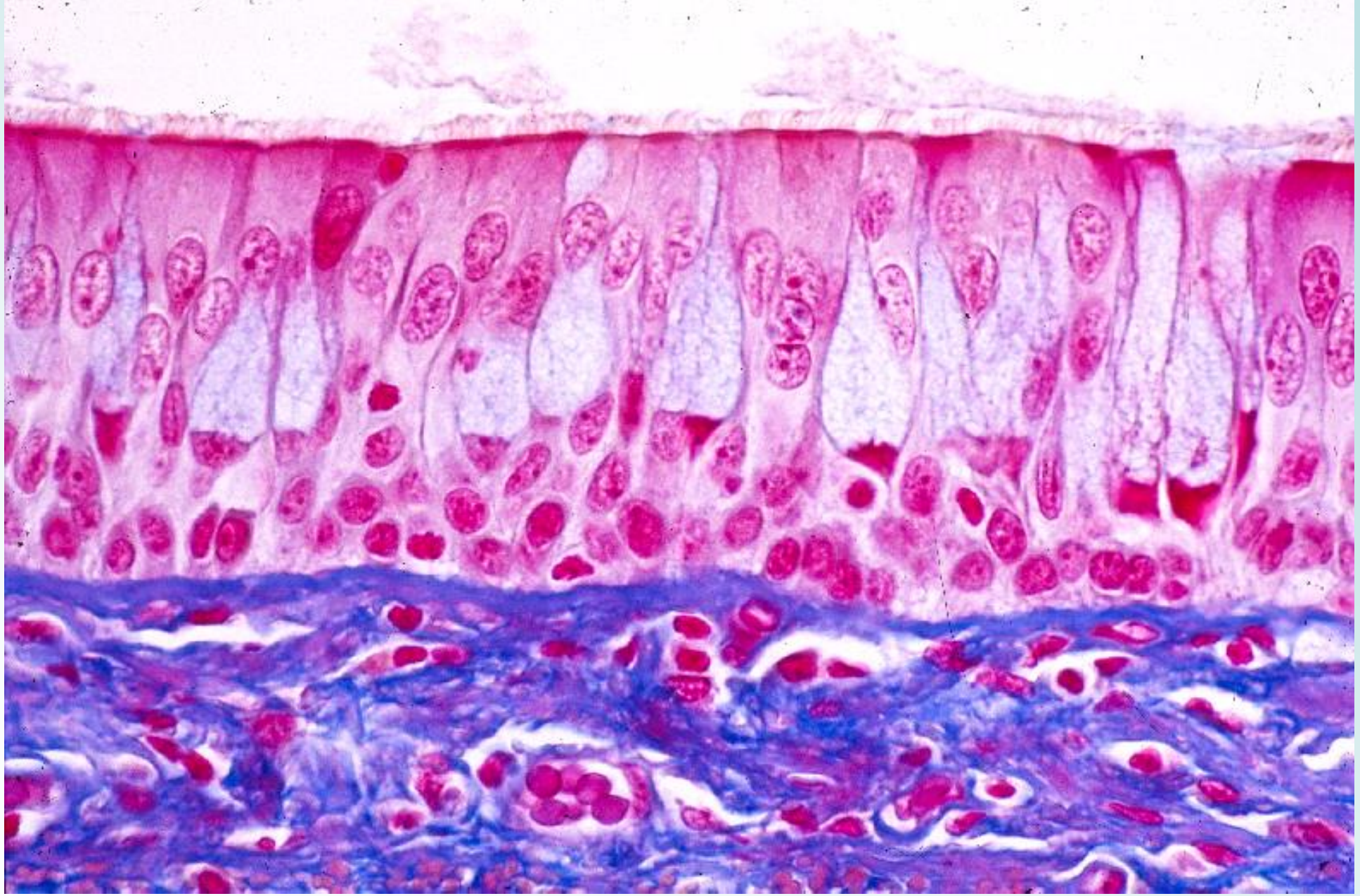
02-09 Simple columnar epithelium 1. Monkey gallbladder, H-E stain, x 160.



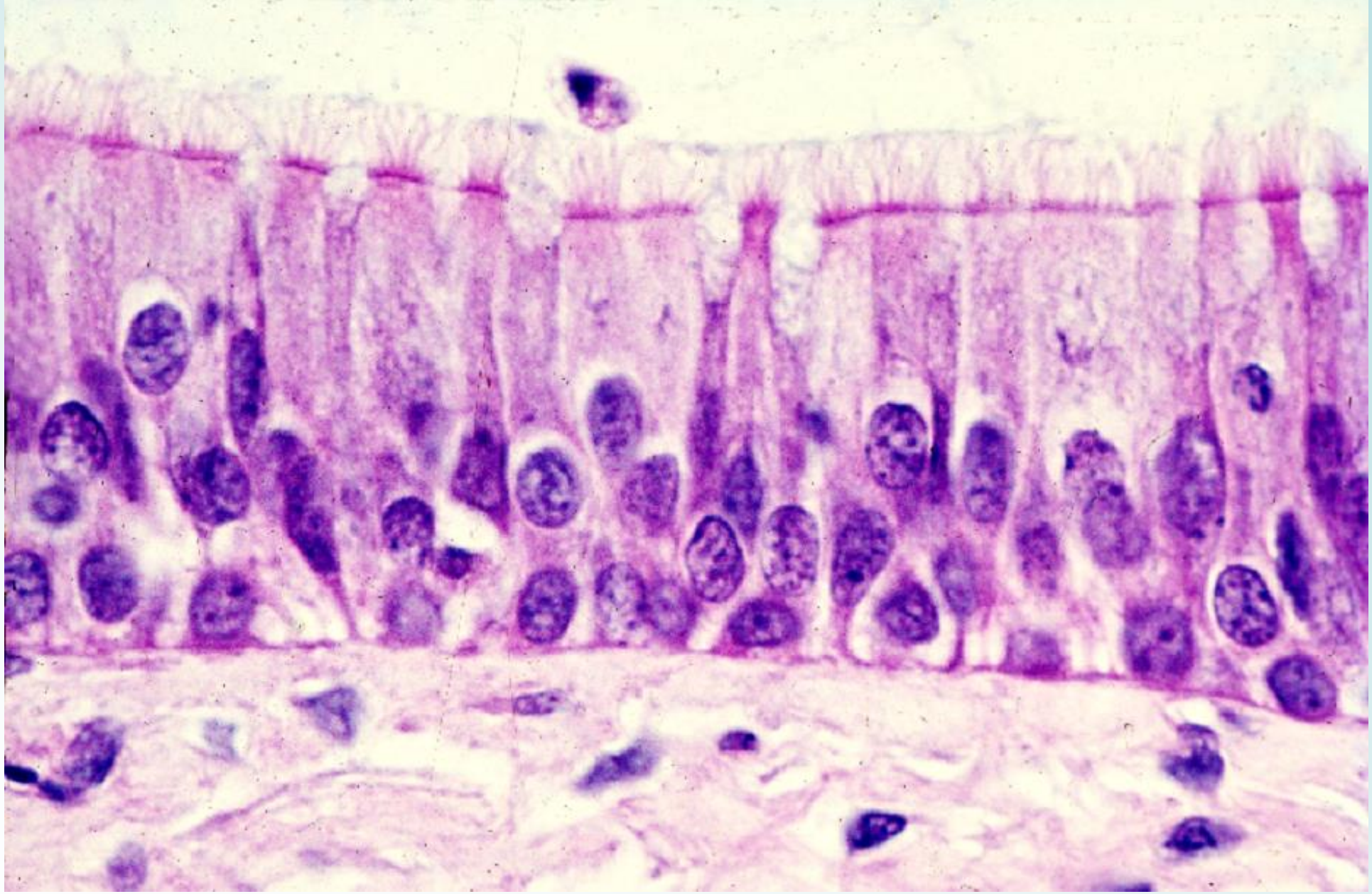
02-10 Simple columnar epithelium 2. Human jejunum, H-E stain, x 400.



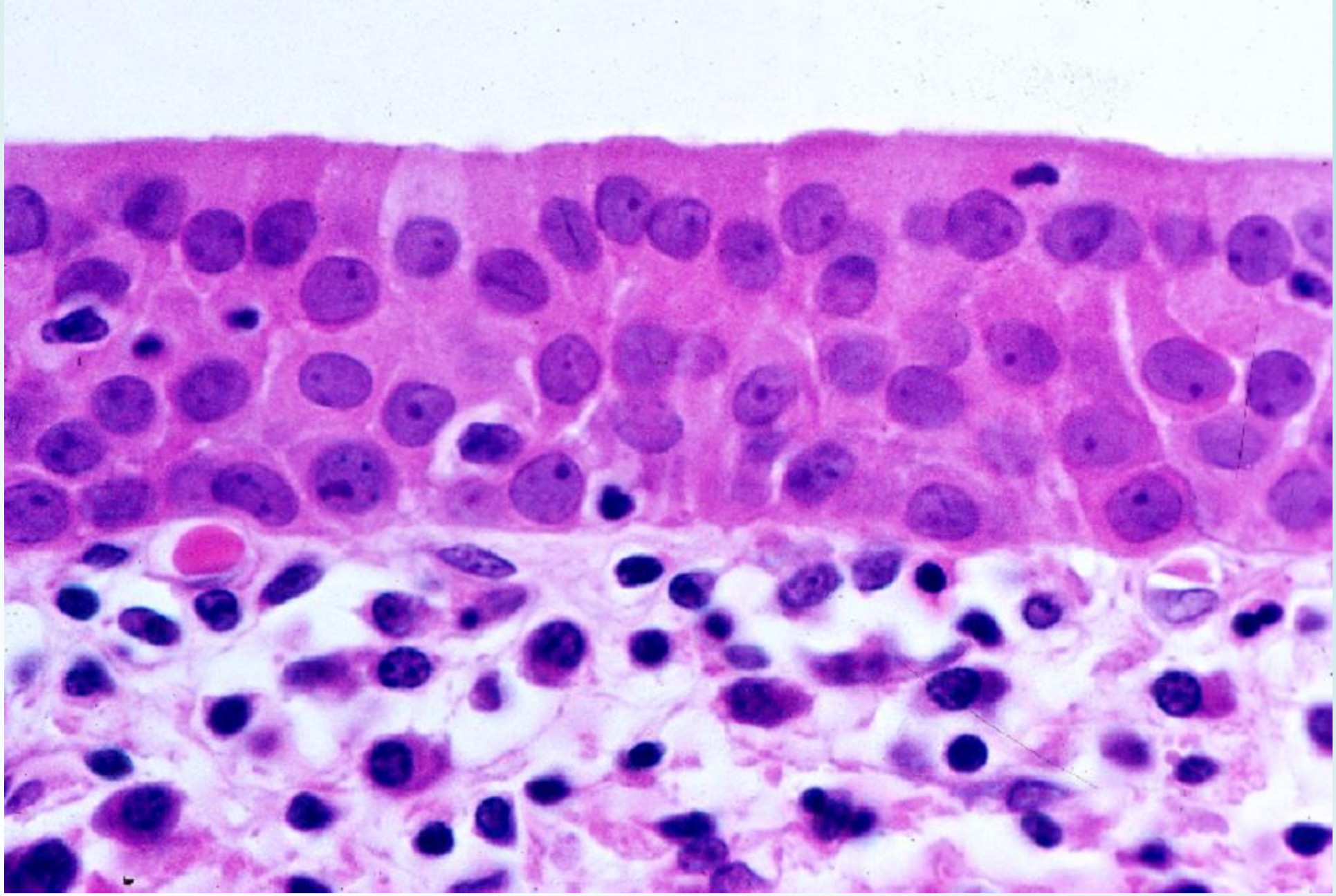
02-11 Pseudostratified ciliated columunar epithelium 1. Human nasal cavity, H-E stain, x 160.



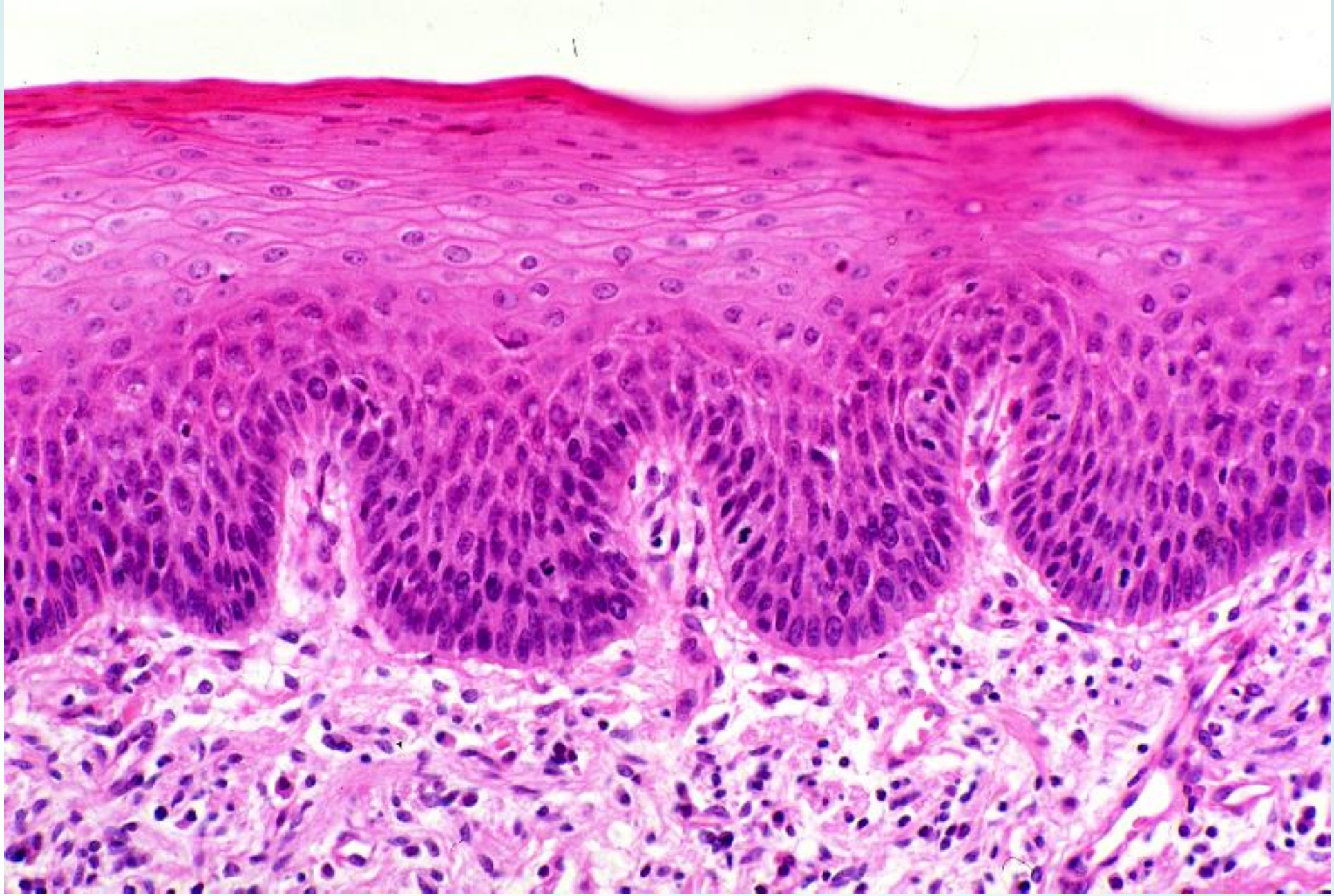
02-12 Pseudostratified ciliated columunar epithelium 2. Human trachea, Azan stain, x 160.



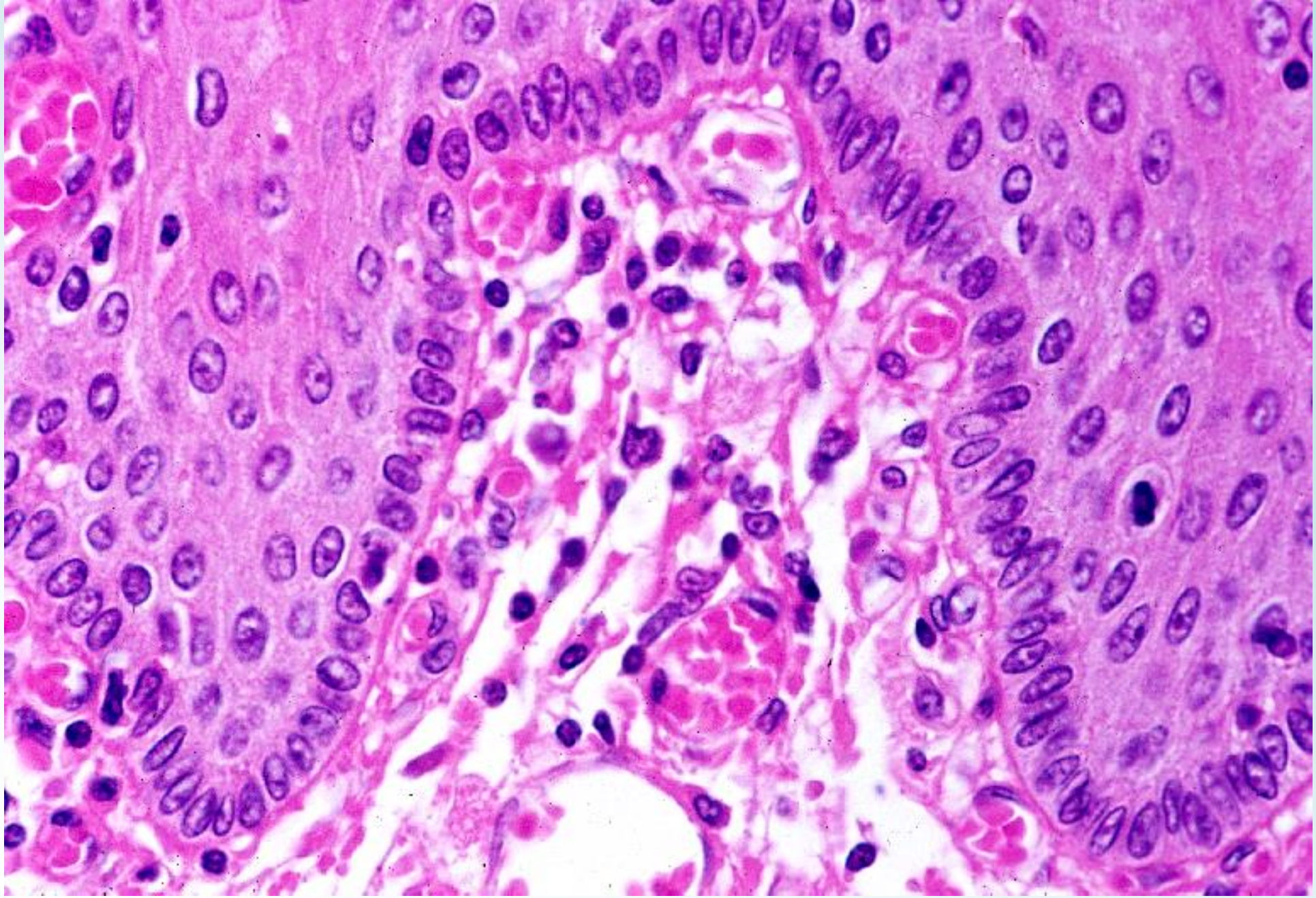
02-13 Pseudostratified ciliated columnar epithelium 3. Human nasal cavity, H-E stain, x 250.



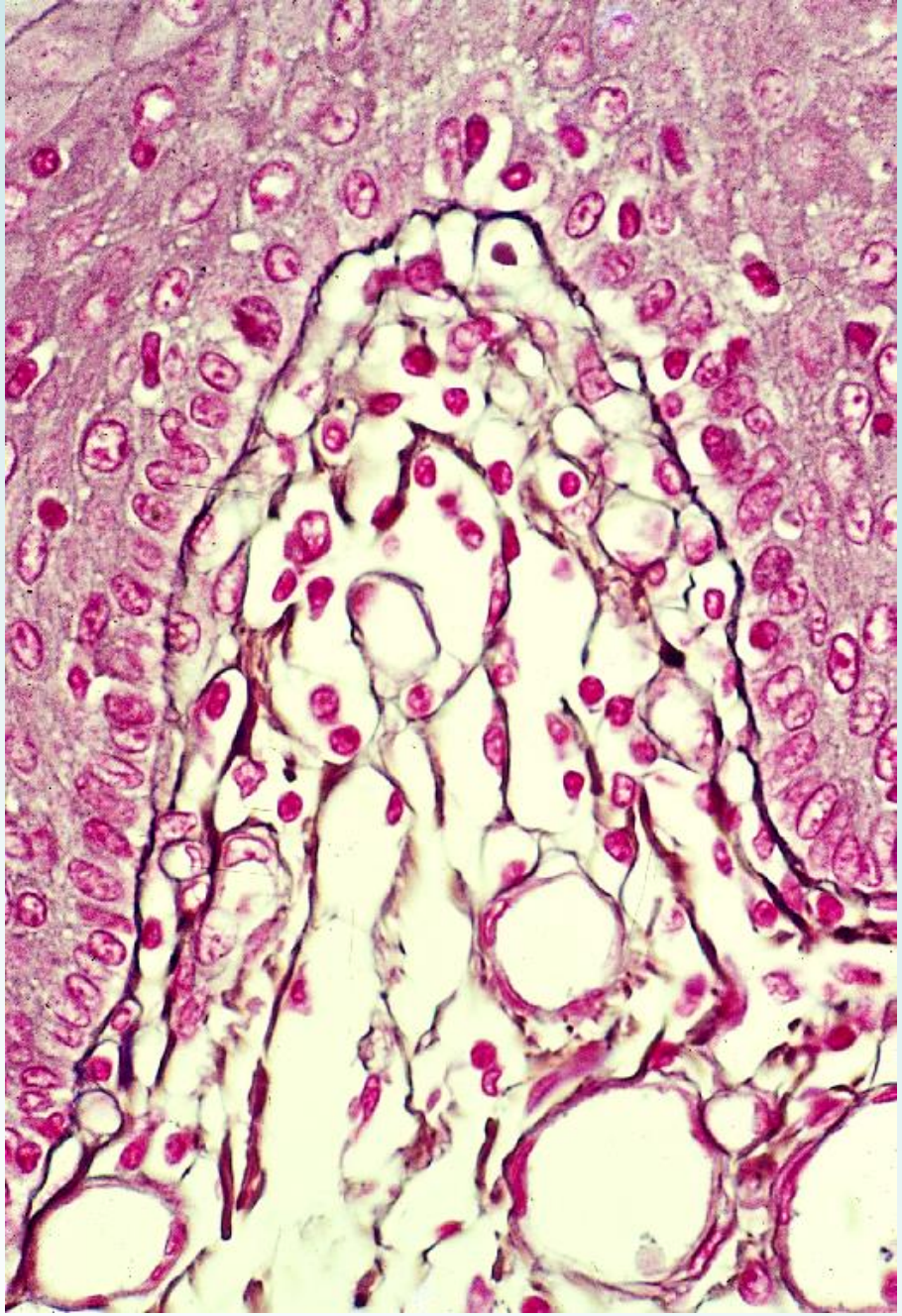
02-14 Stratified columnar epithelium. Human conjunctiva, H-E stain, x 250.



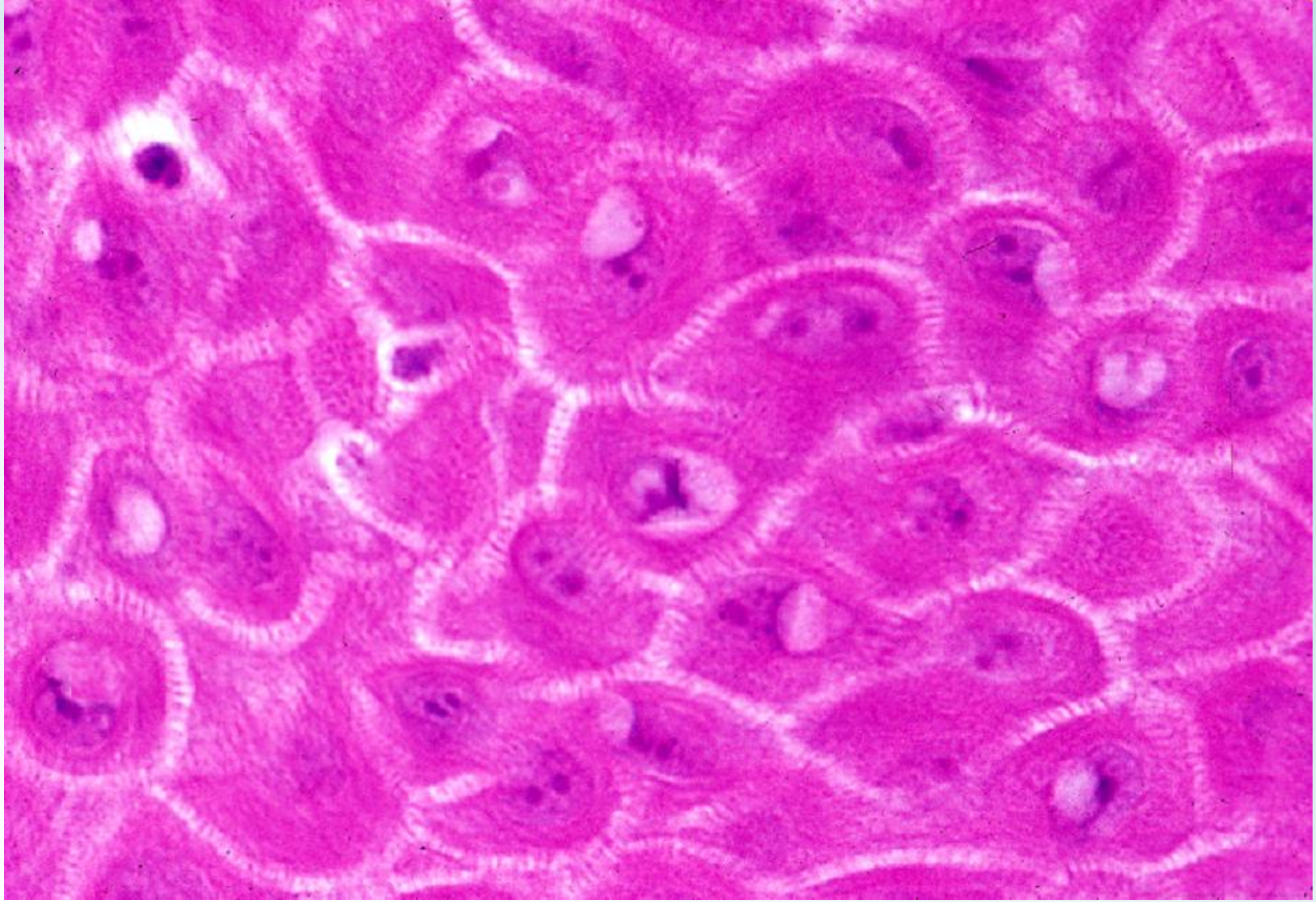
02-15 Stratified squamous epithelium 1. Human tongue, H-E stain, x 66.



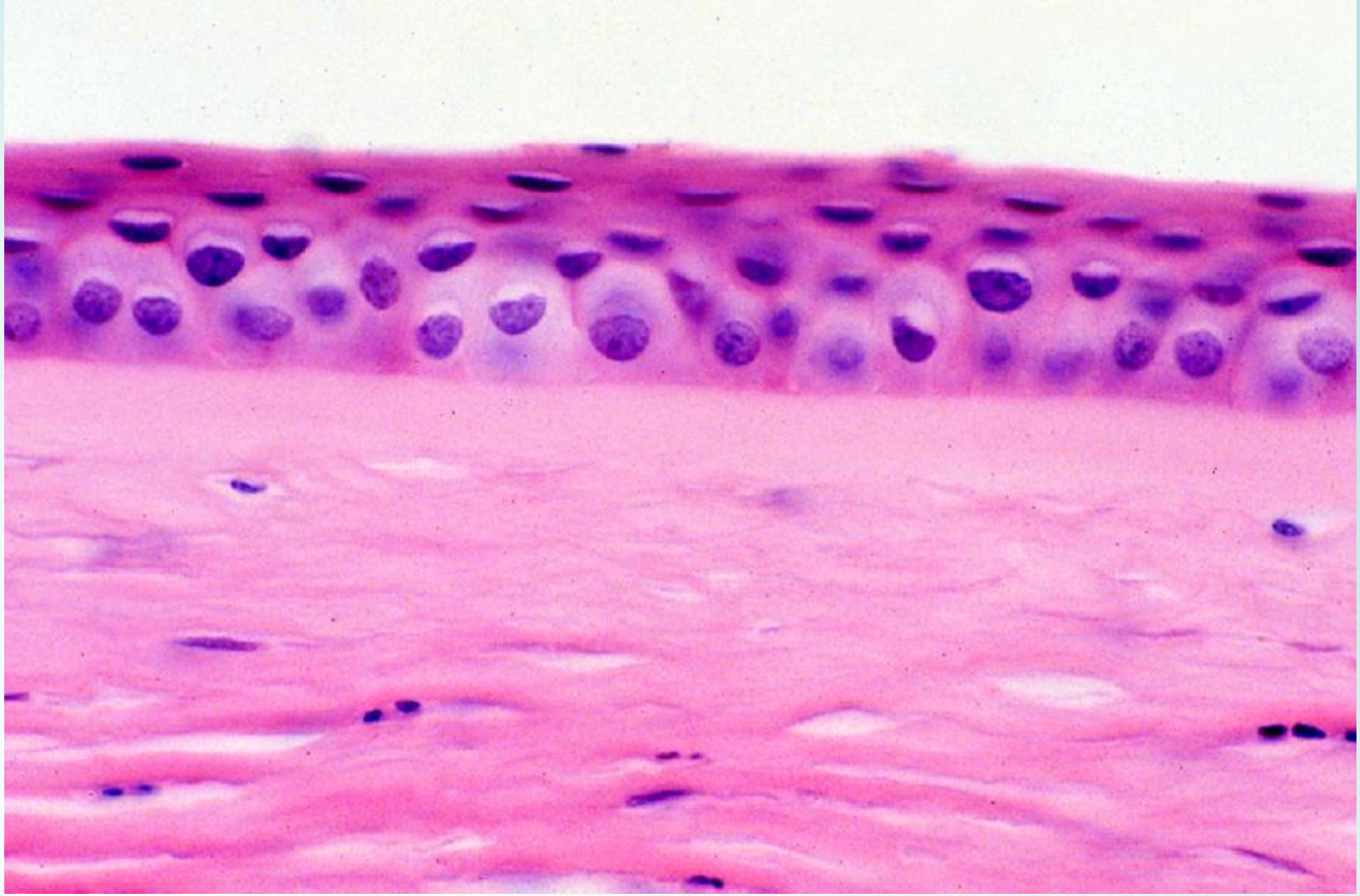
02-16 Stratified squamous epithelium 2. Human tongue, H-E stain, x 160.



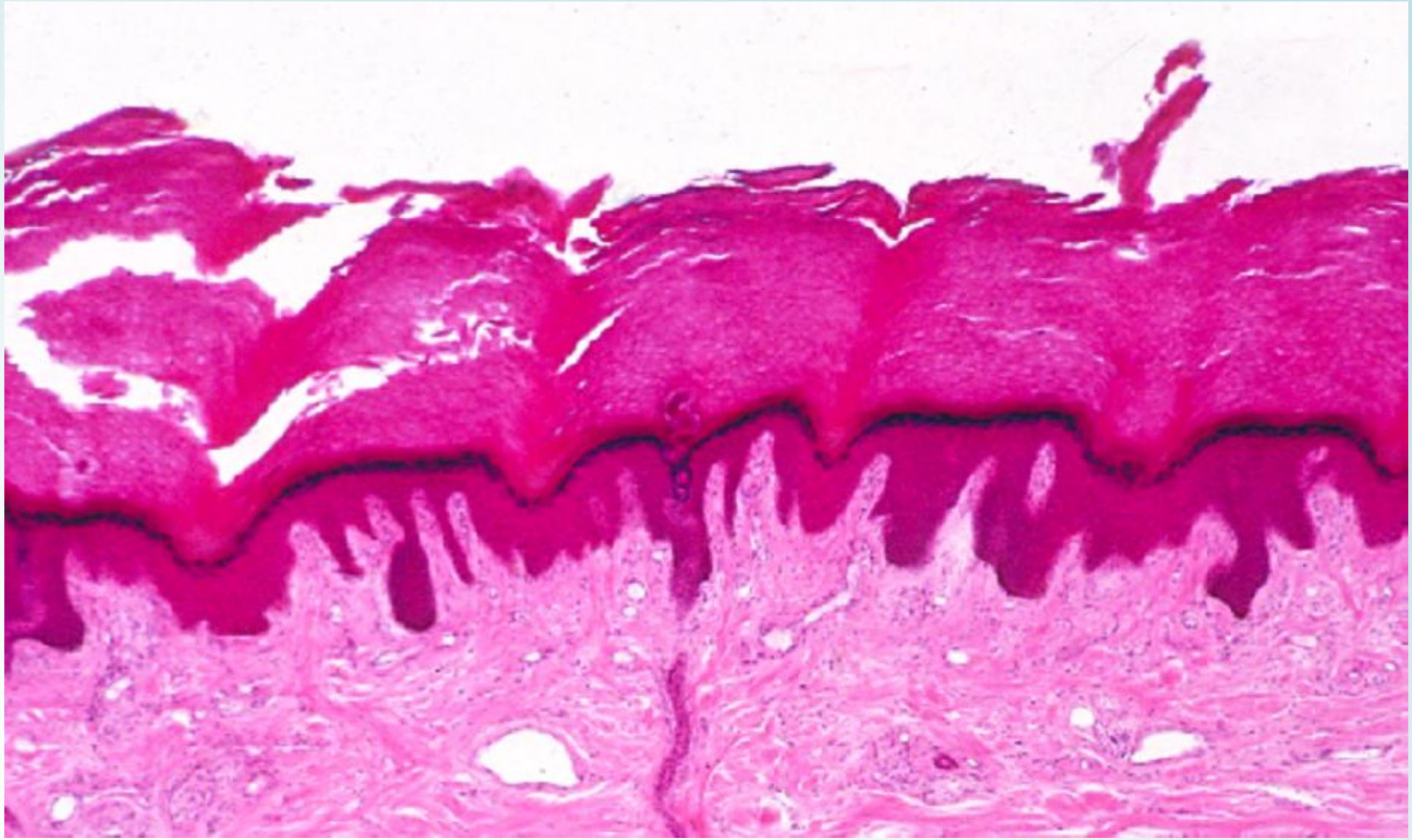
02-17 Stratified squamous epithelium, papilla. Human tongue, silver impregnation, x 160.



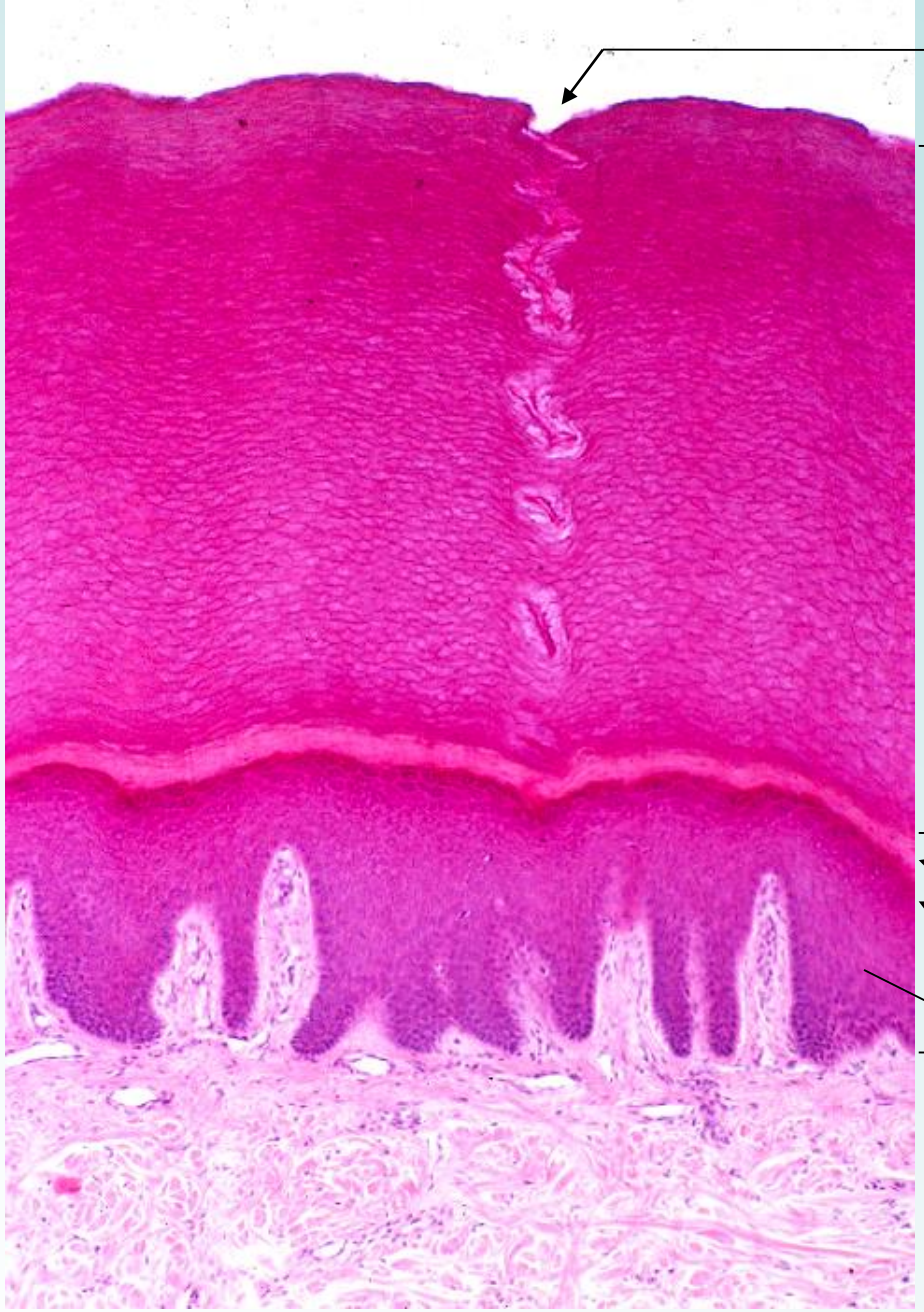
02-18 Stratified squamous epithelium, intercellular bridges. Human tongue, H-E stain, x 250.



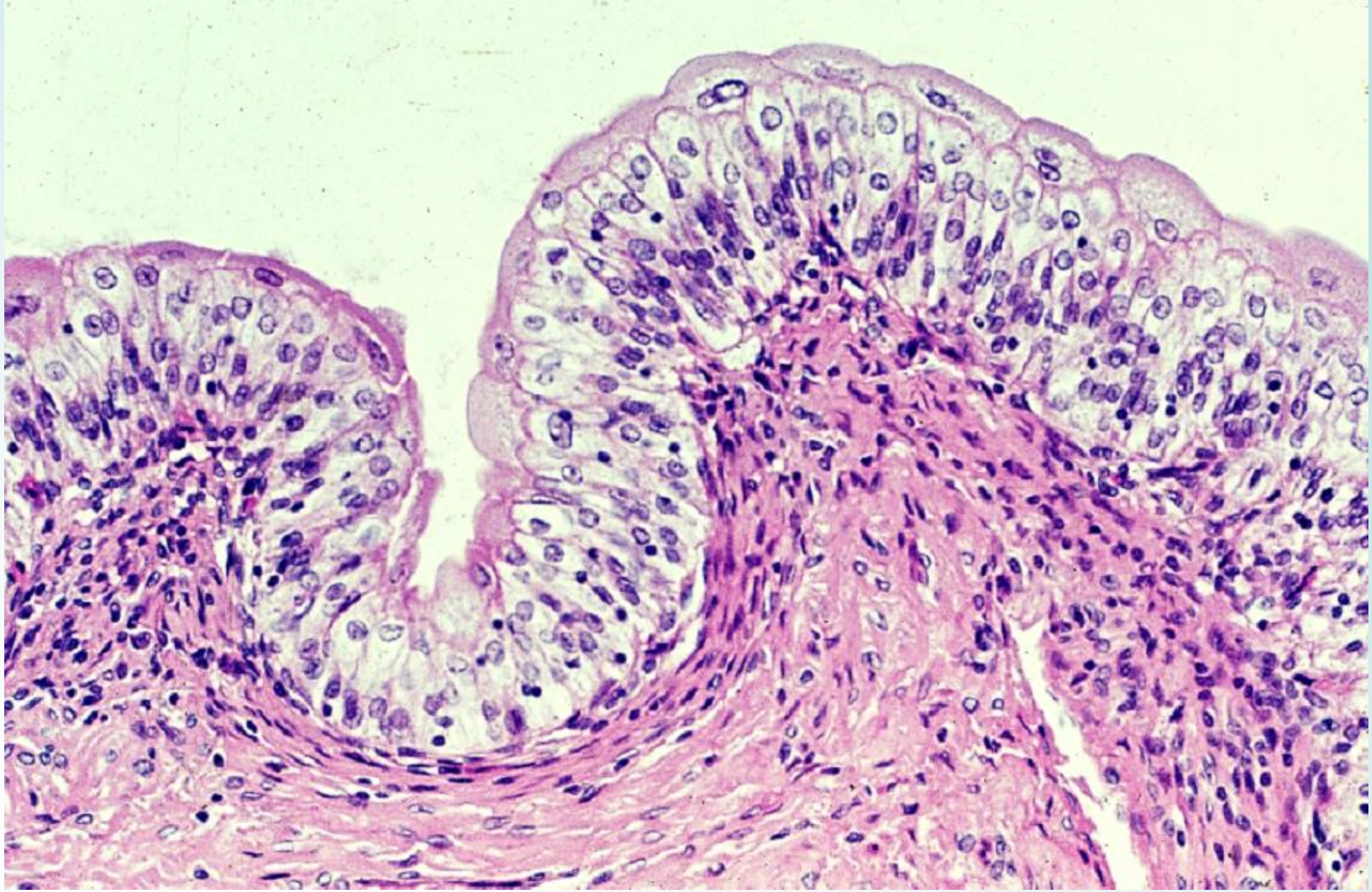
02-19 Stratified squamous epithelium. Human cornea, not keratinized, H-E stain, x 160.



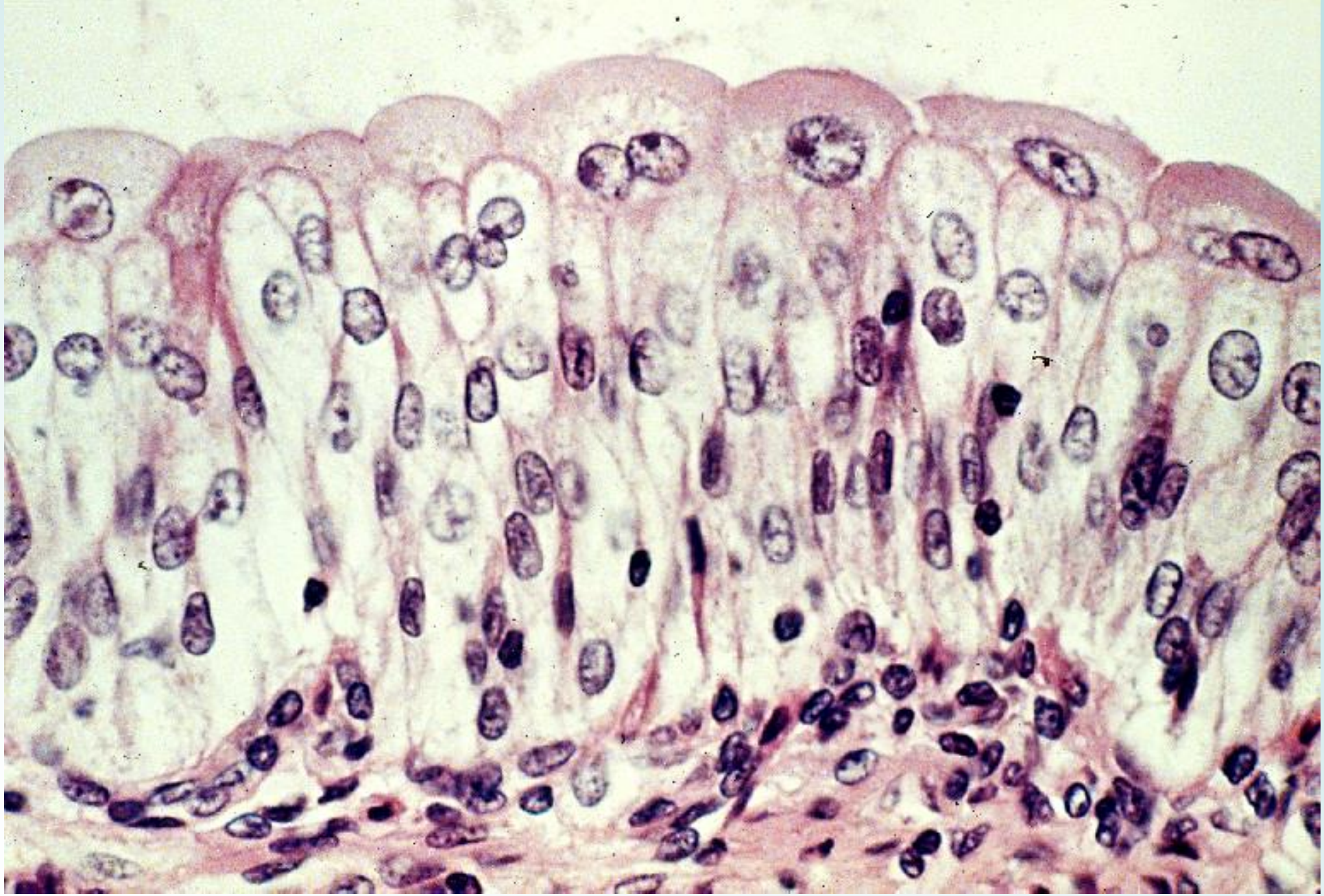
02-20 Stratified squamous epithelium with keratinization. Human thumb-tip, H-Estain, x 64.



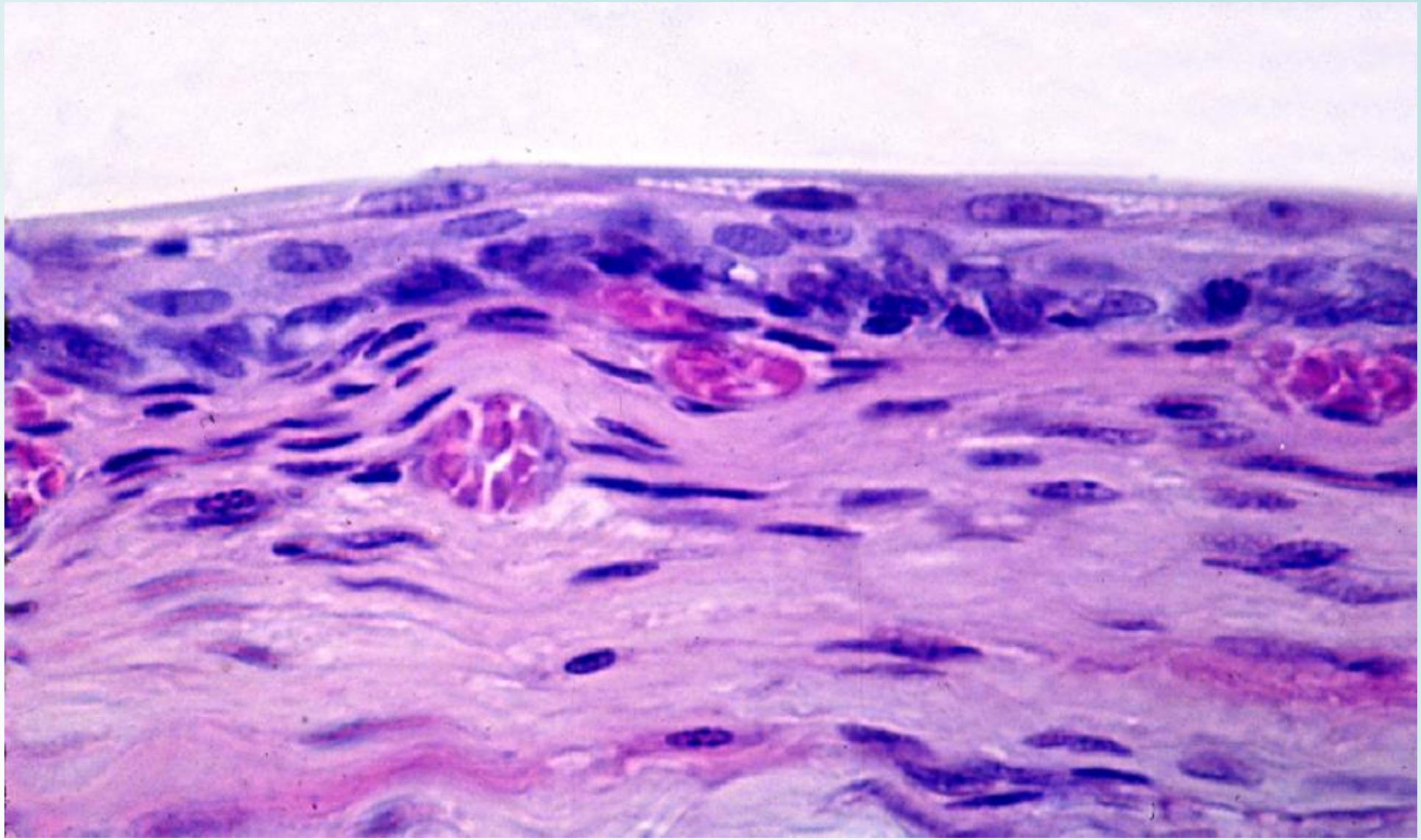
02-21 Stratified squamous epithelium with keratinization 2. Human palm, H-E stain, x 25.



02-22 Transitional epithelium 1. Human urinary bladder, H-E stain, x 64.

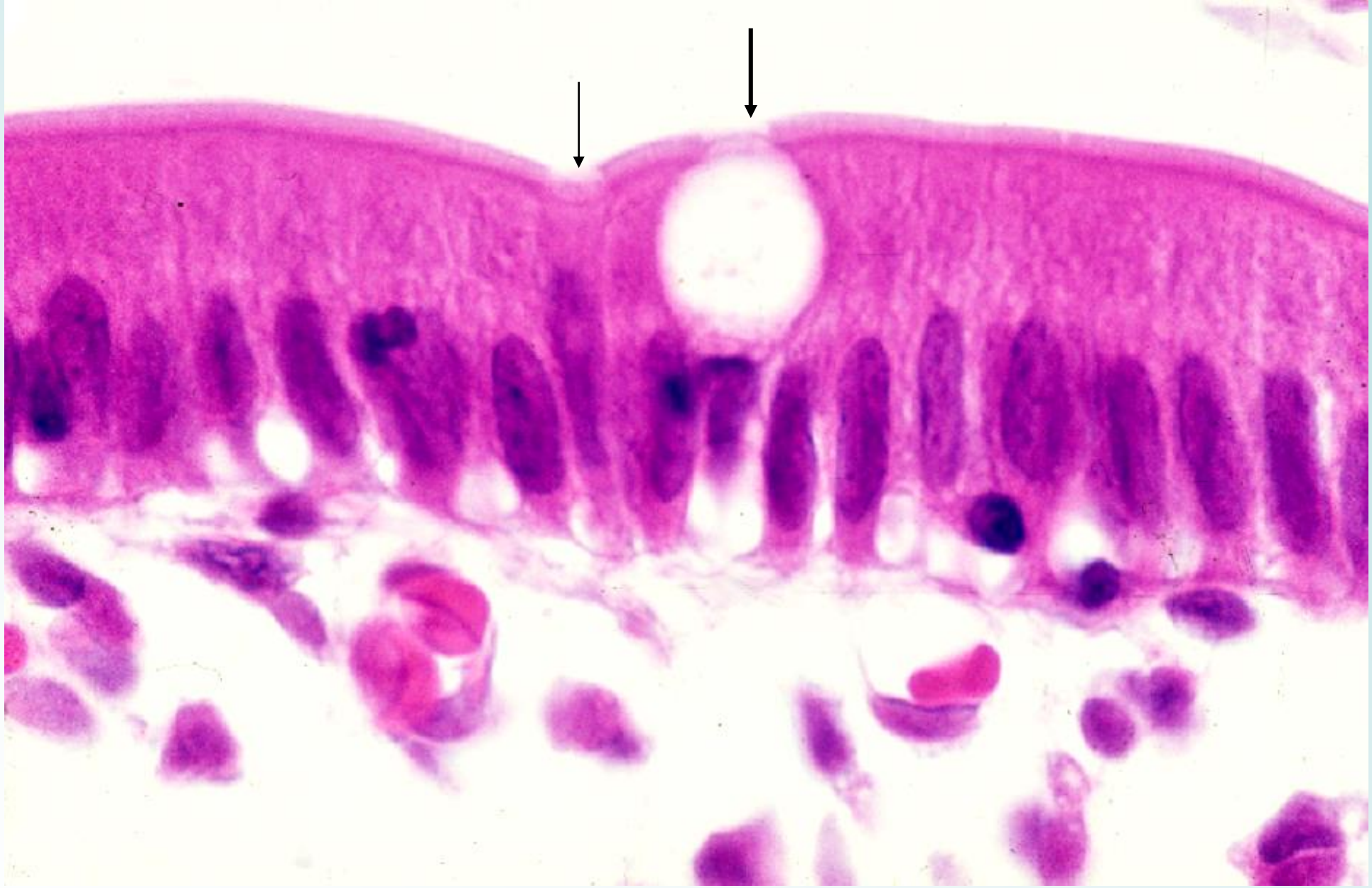


02-23 Transitional epithelium 2. Human urinary bladder, H-E stain, x160.

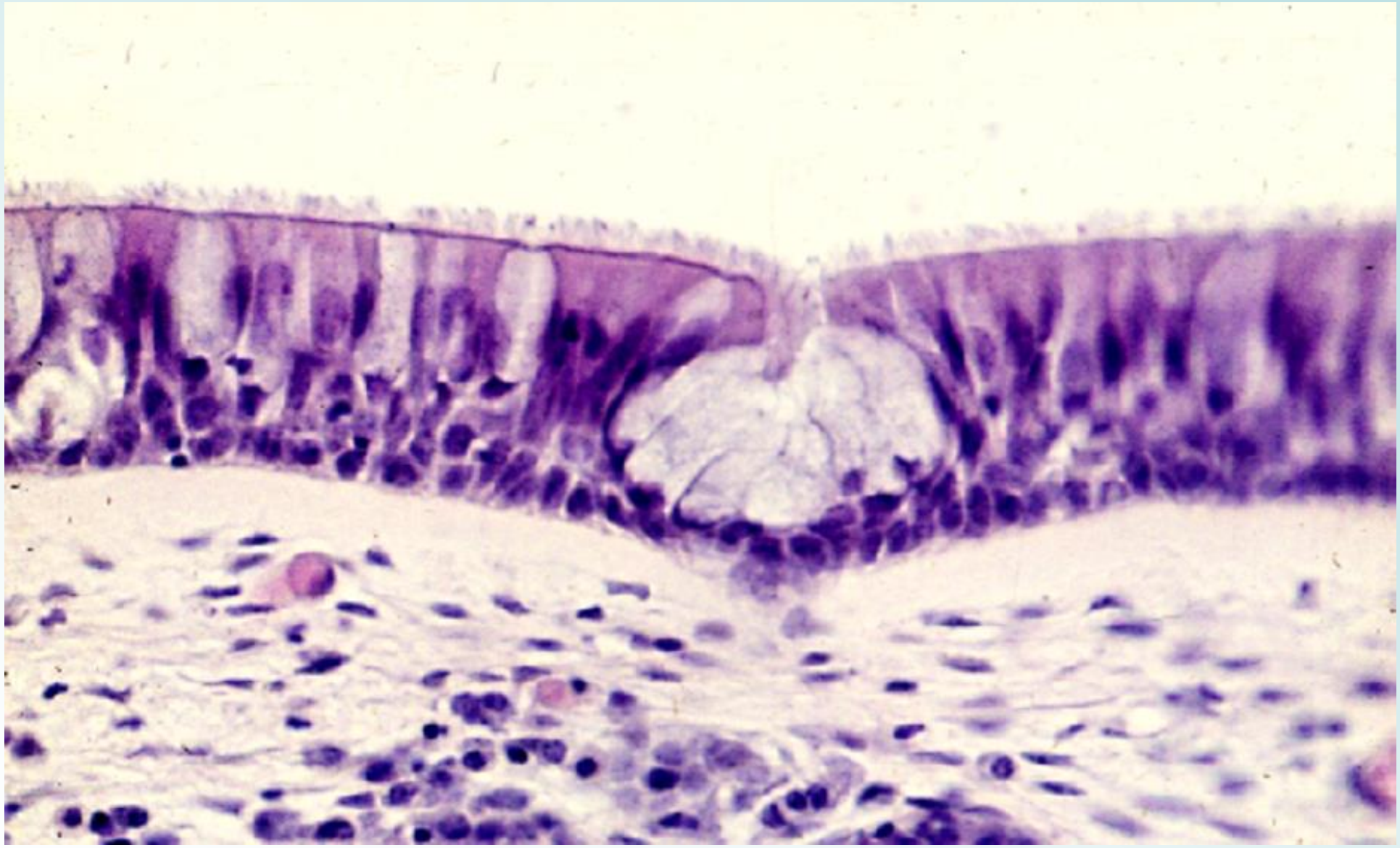


02-24 Transitional epithelium 3. Human urinary bladder, H-E stain, x 200.

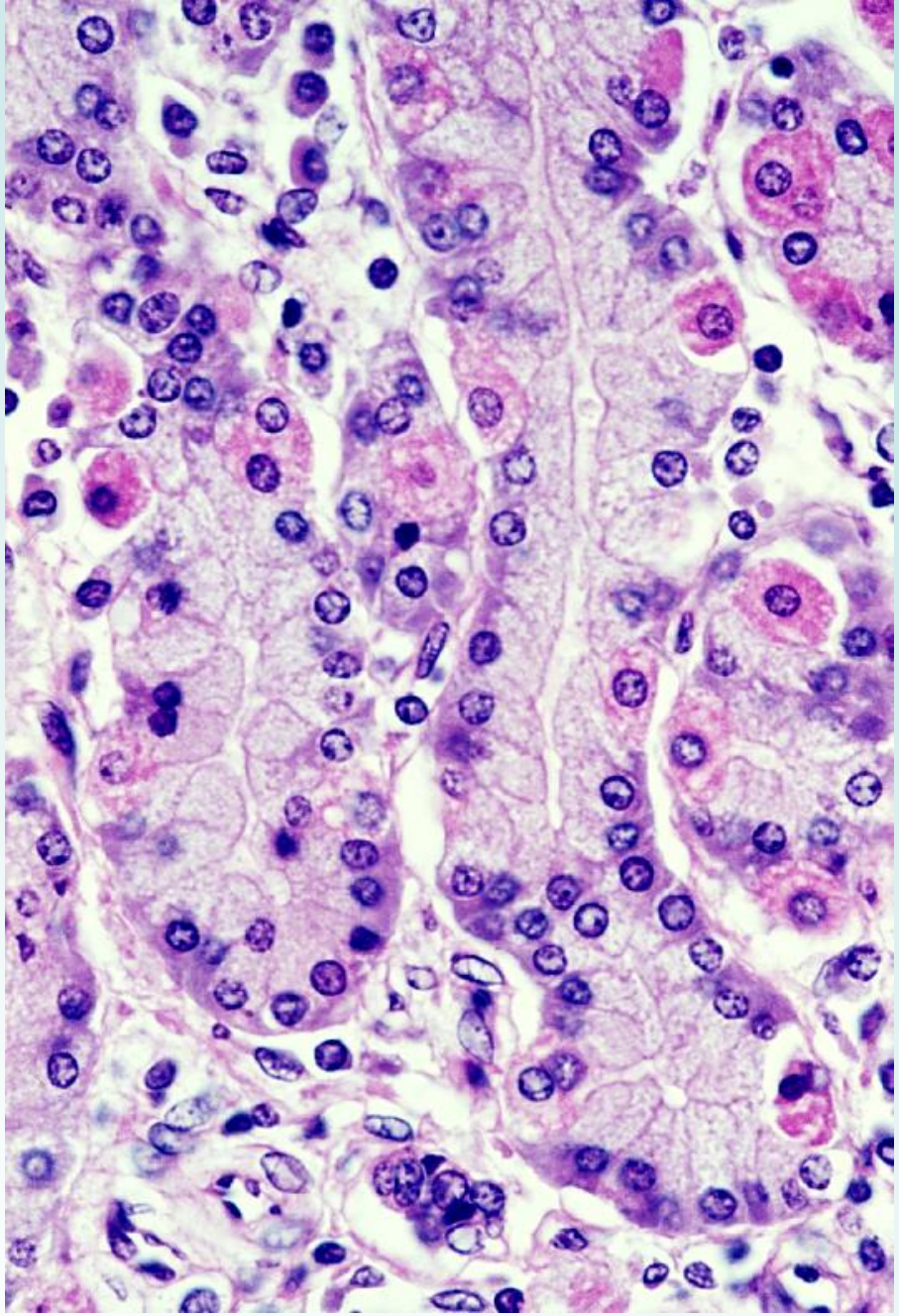
02-002
Gland



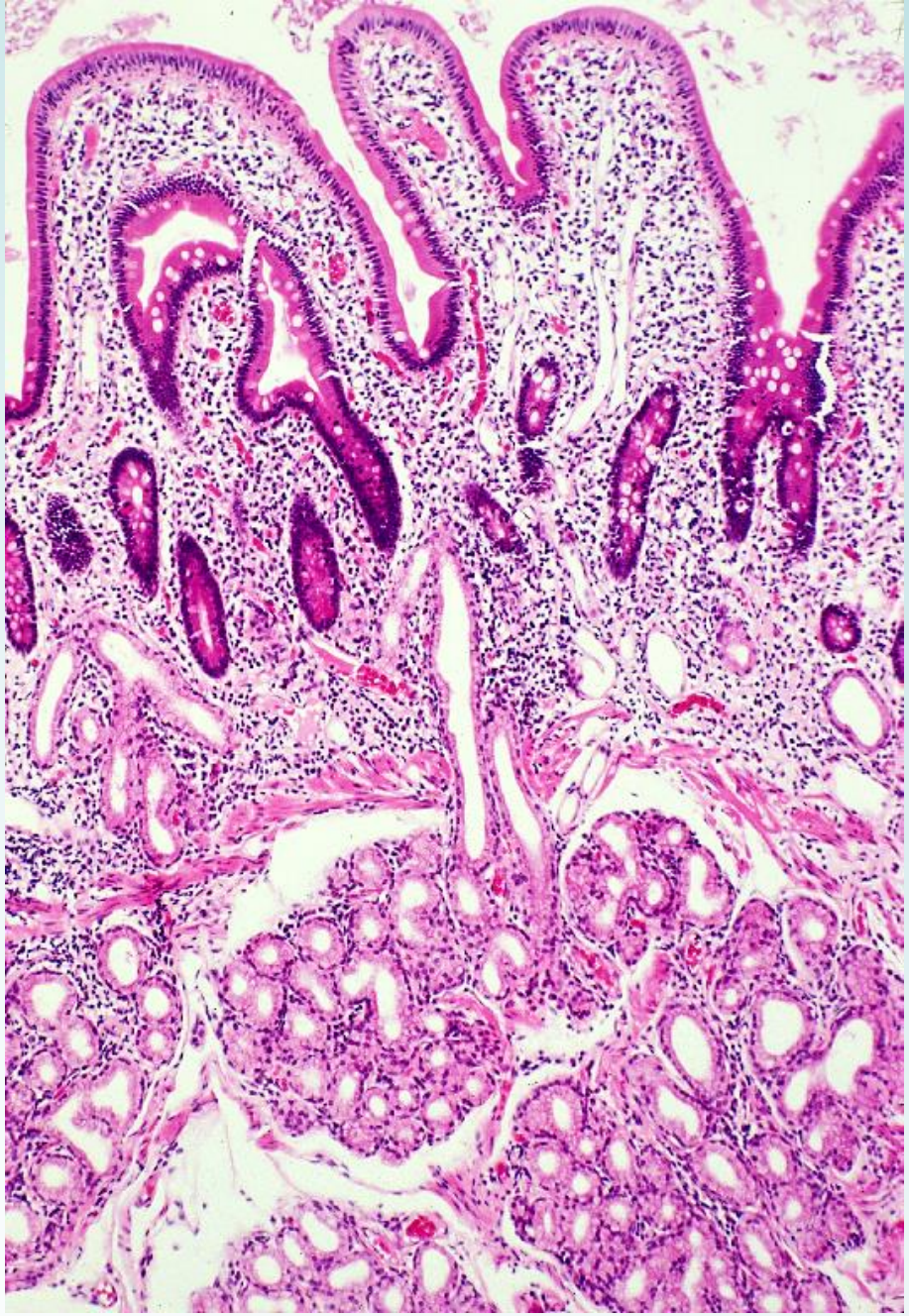
02-25 Unicellular gland. Human intestinal epithelium, H-E stain, x 400.



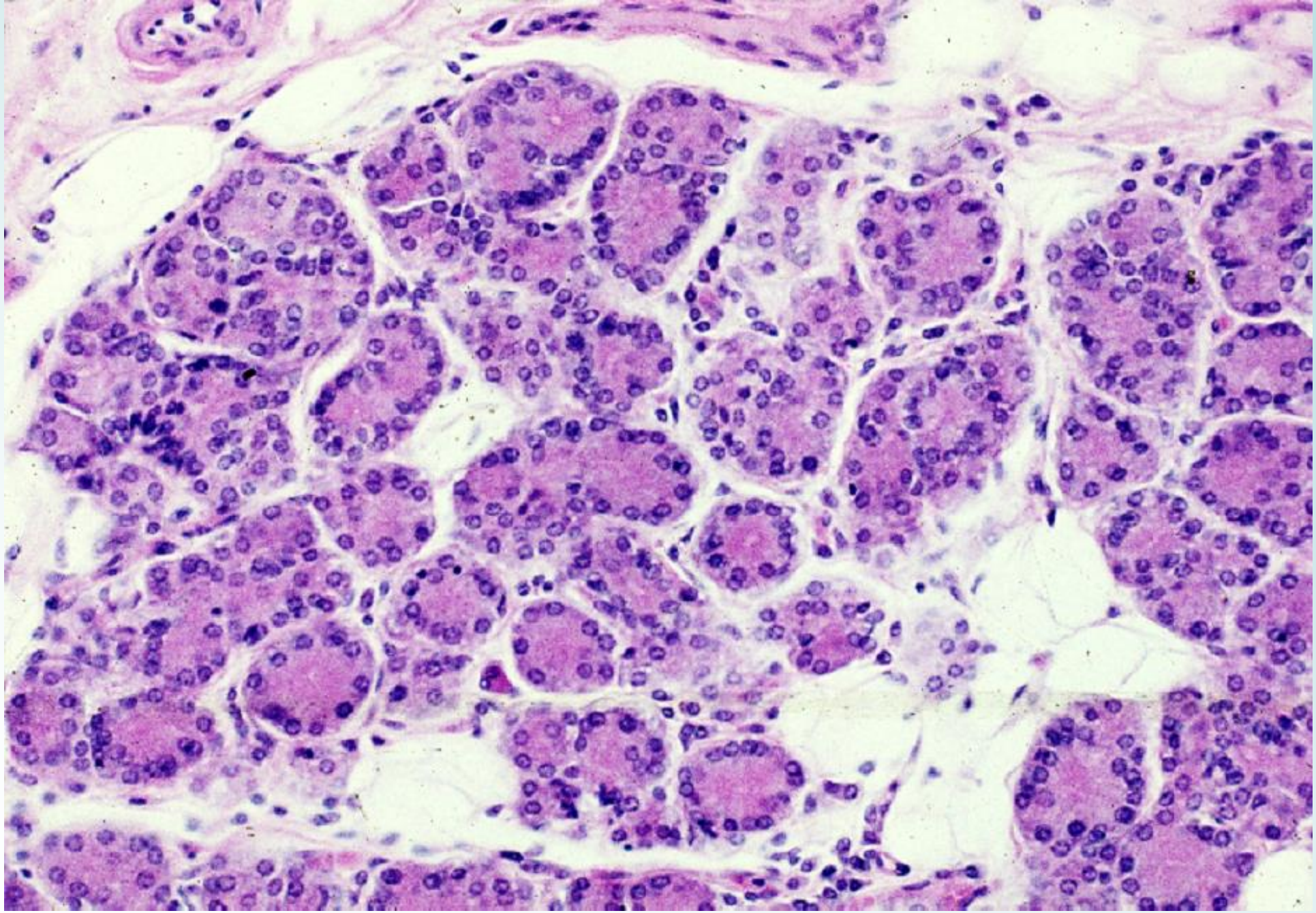
02-26 Multicellular intraepitheliar gland. Human nasal mucosa, H-E stain, x 100.



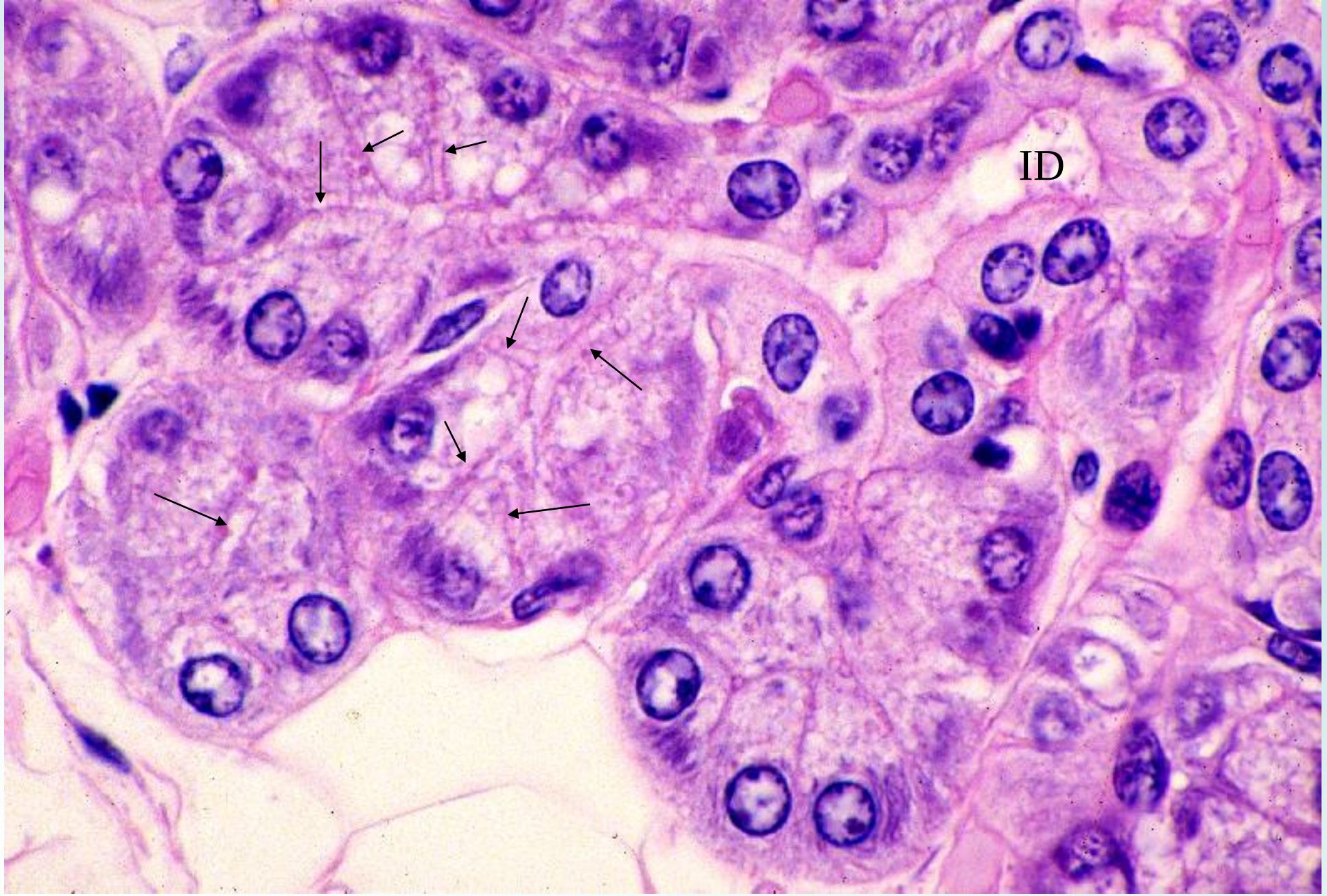
02-27 Tubular glands. Human gastric glands, H-E stain, x 160.



02-28 Alveolar glands. Human duodenal glands, H-E stain, x 25.

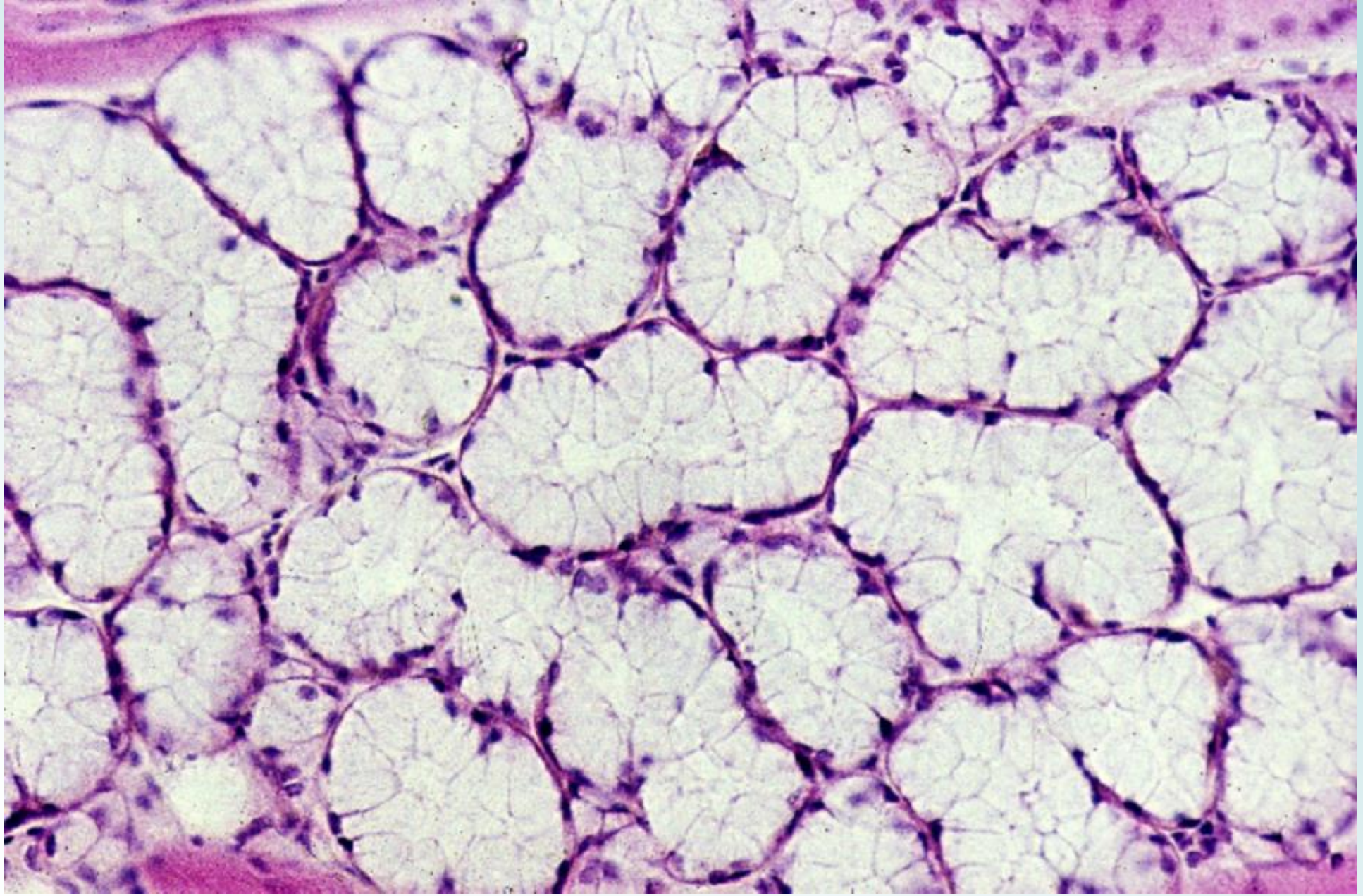


02-29 Serous glands 1. Human lingual gland, H-E stain, x 64.

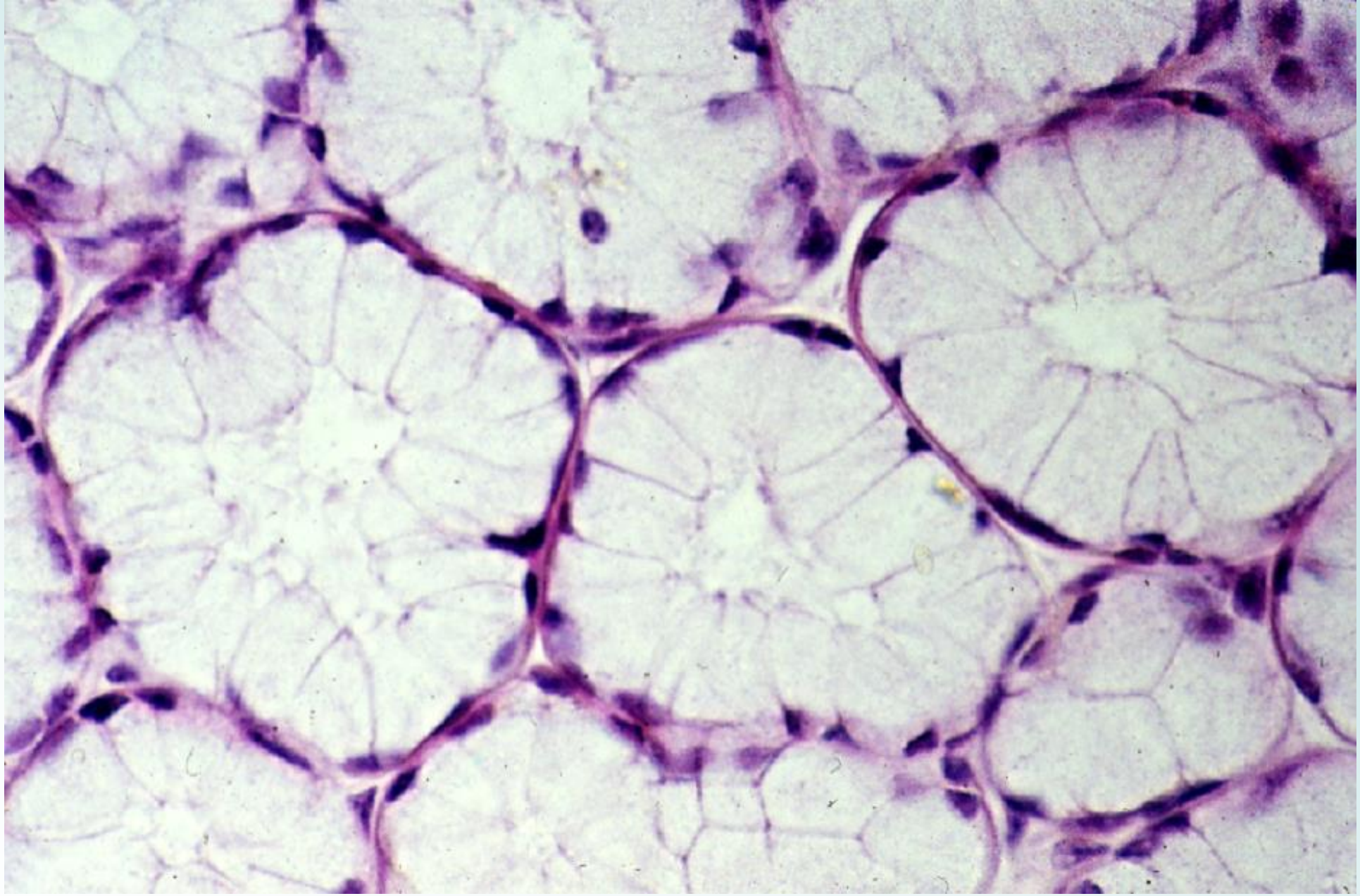


02-30 Serous glands 2. Human submandibular gland. H-E stain, x 250.

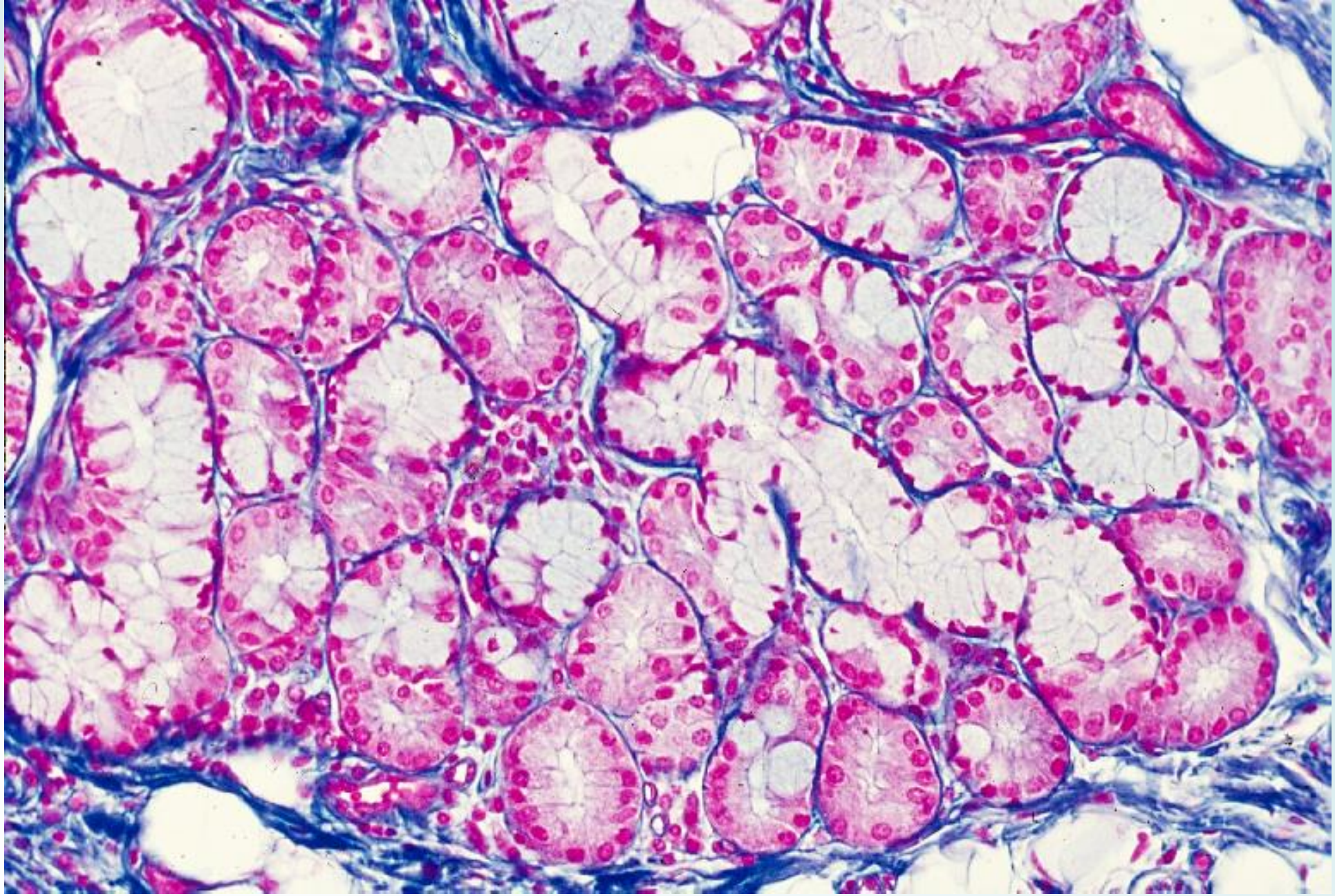
02-31 Serous gland 3. Rabbit, Heidenhain' iron-hematoxylin stain, x 250.



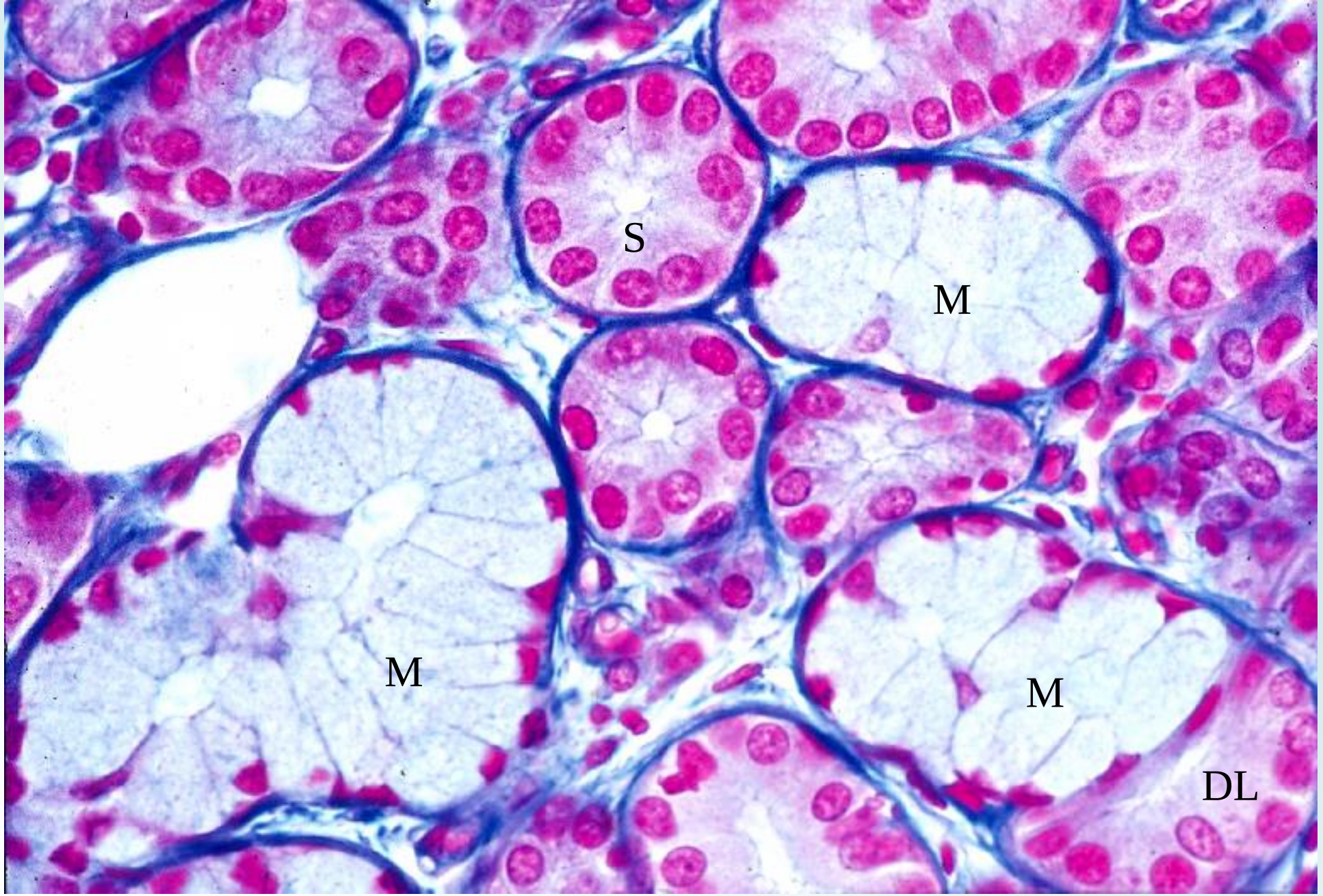
02-32 Mucous gland 1.Monkey, H-E stain, x 64.



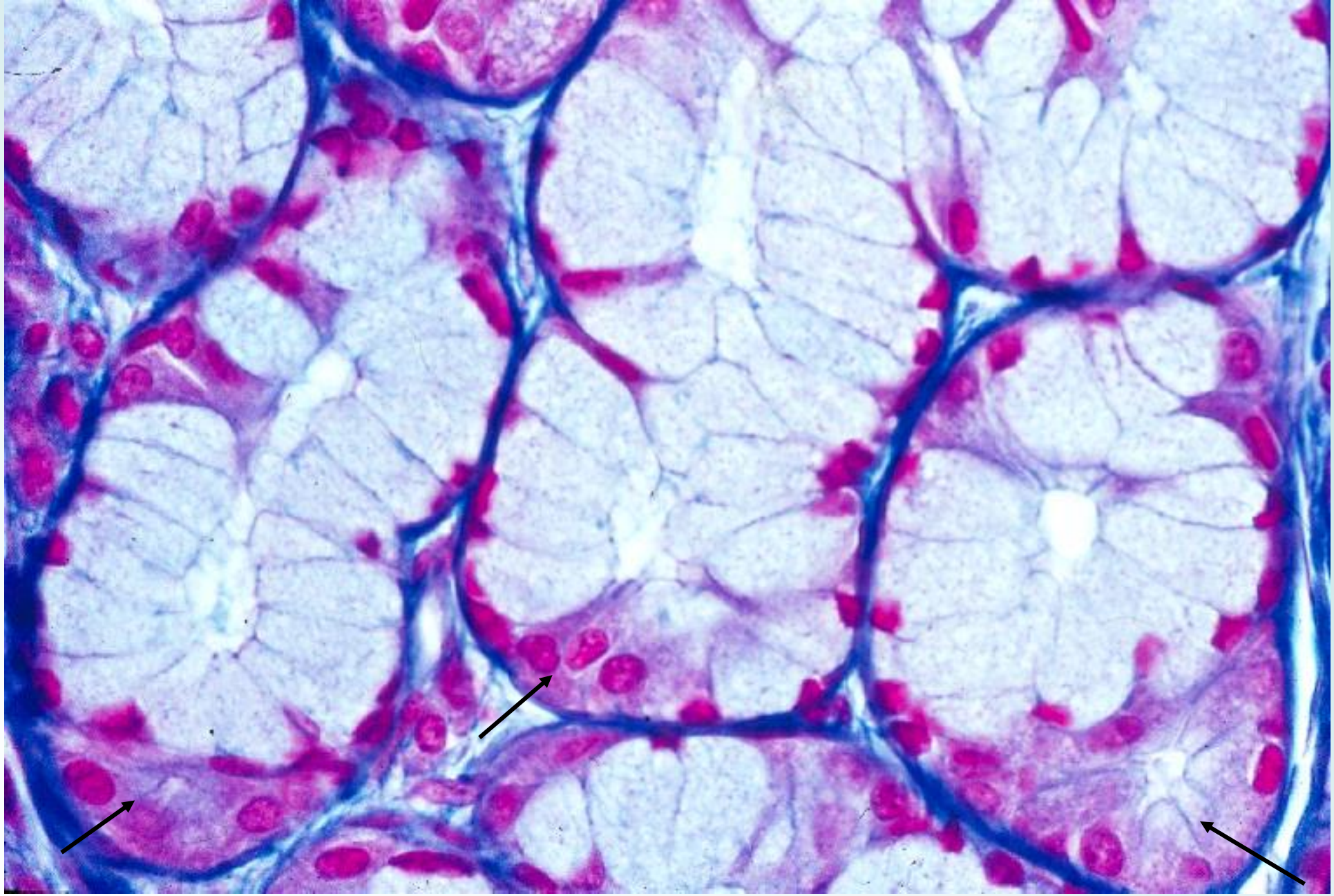
02-33 Mucous gland 2. Monkey, H-E stain, x 160.



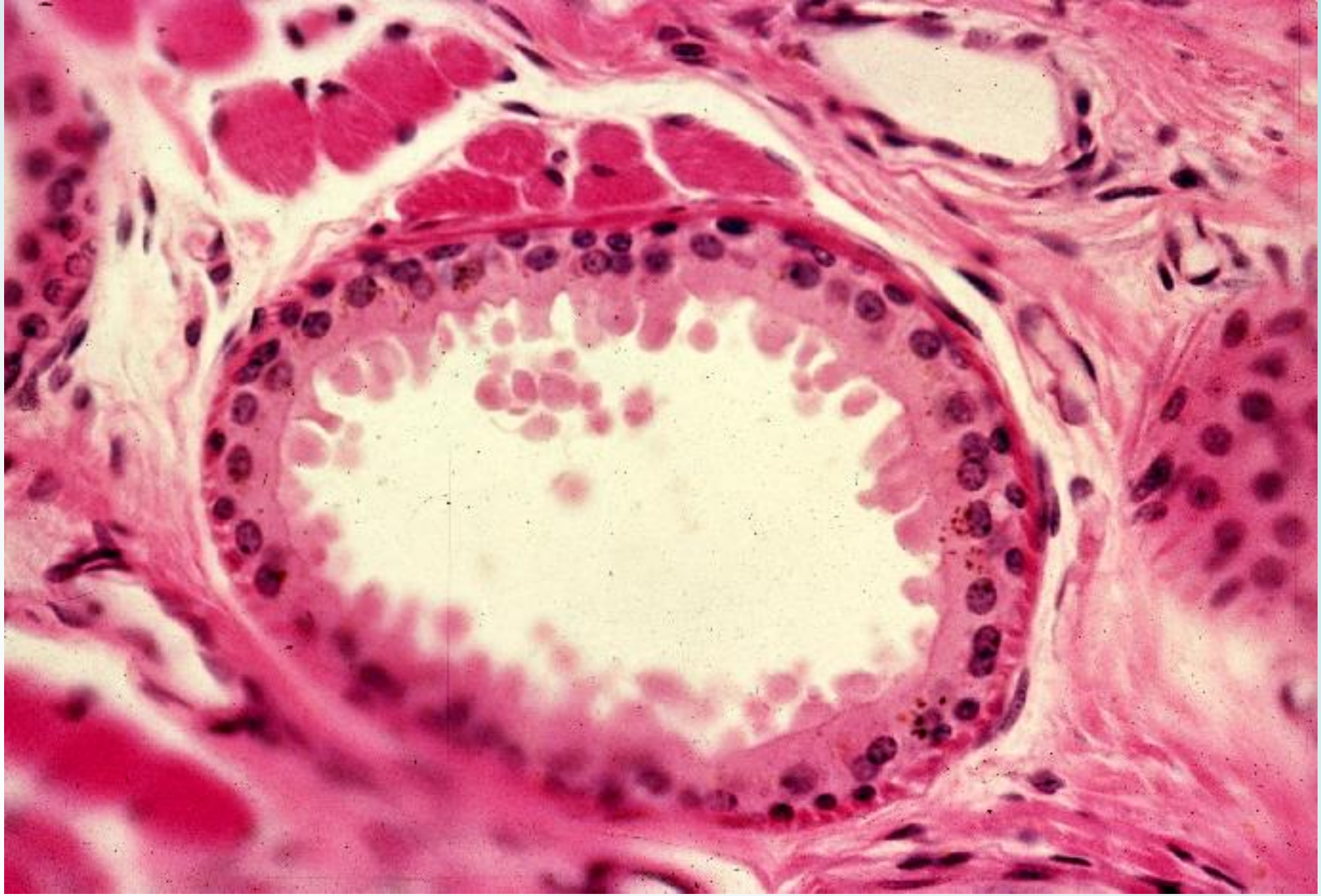
02-34 Mixed gland 1. Cat tracheal gland, Azan stain, x 63.



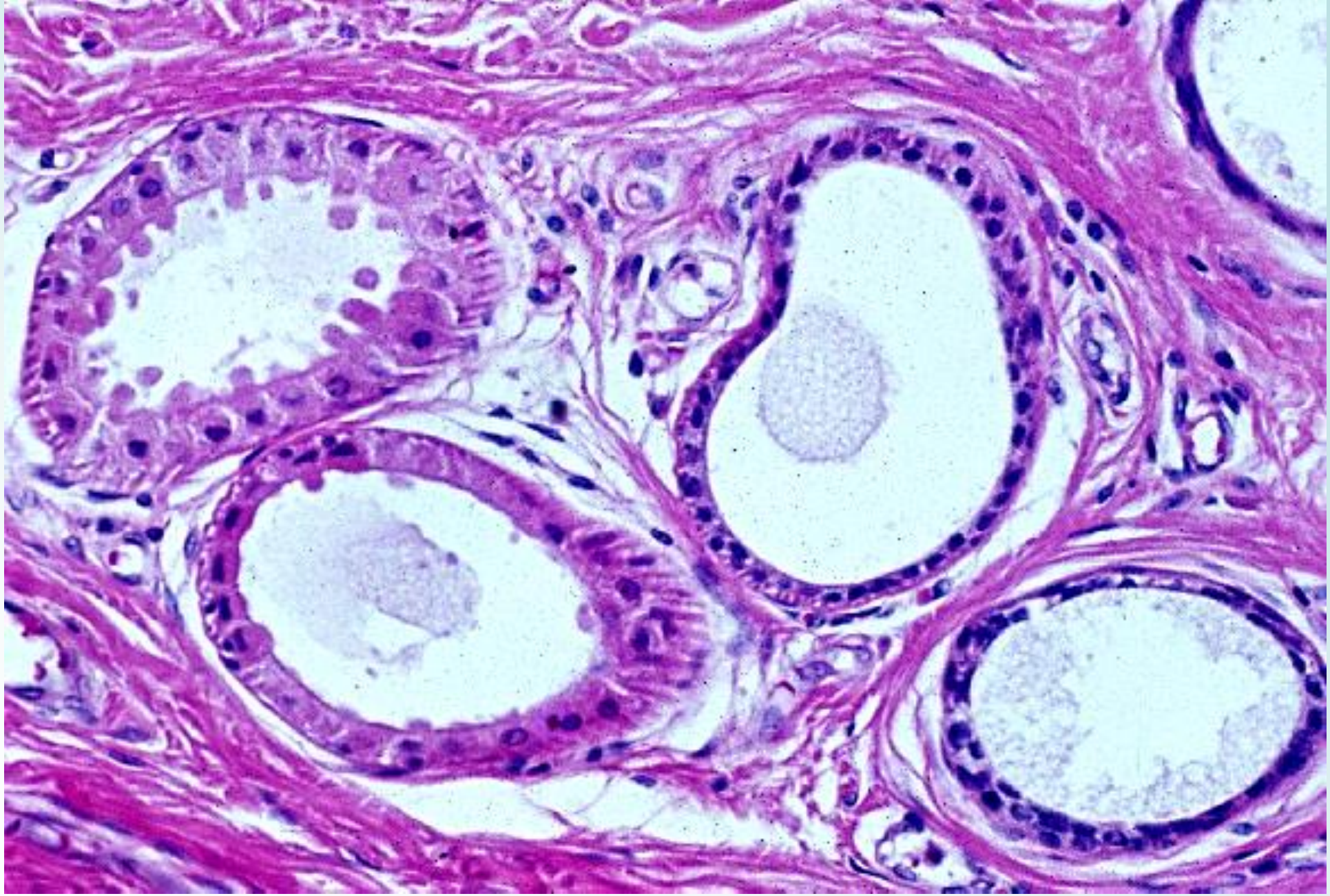
02-35 Mixed gland 2. Cat tracheal gland, Azan stain, x 160.



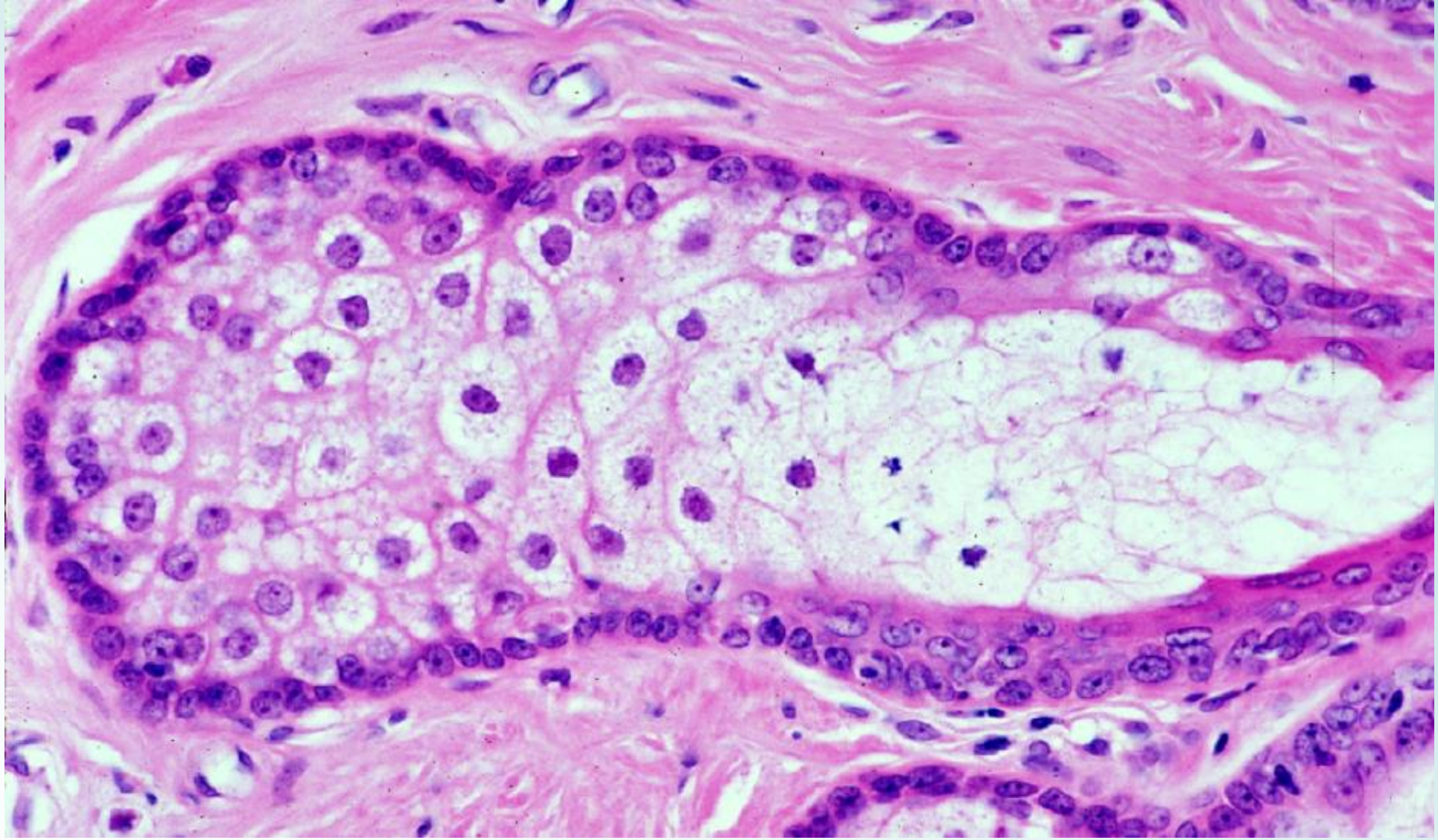
02-36 Mixed gland 3. Dumilunes. Cat tracheal gland, Azan stain, x 160.



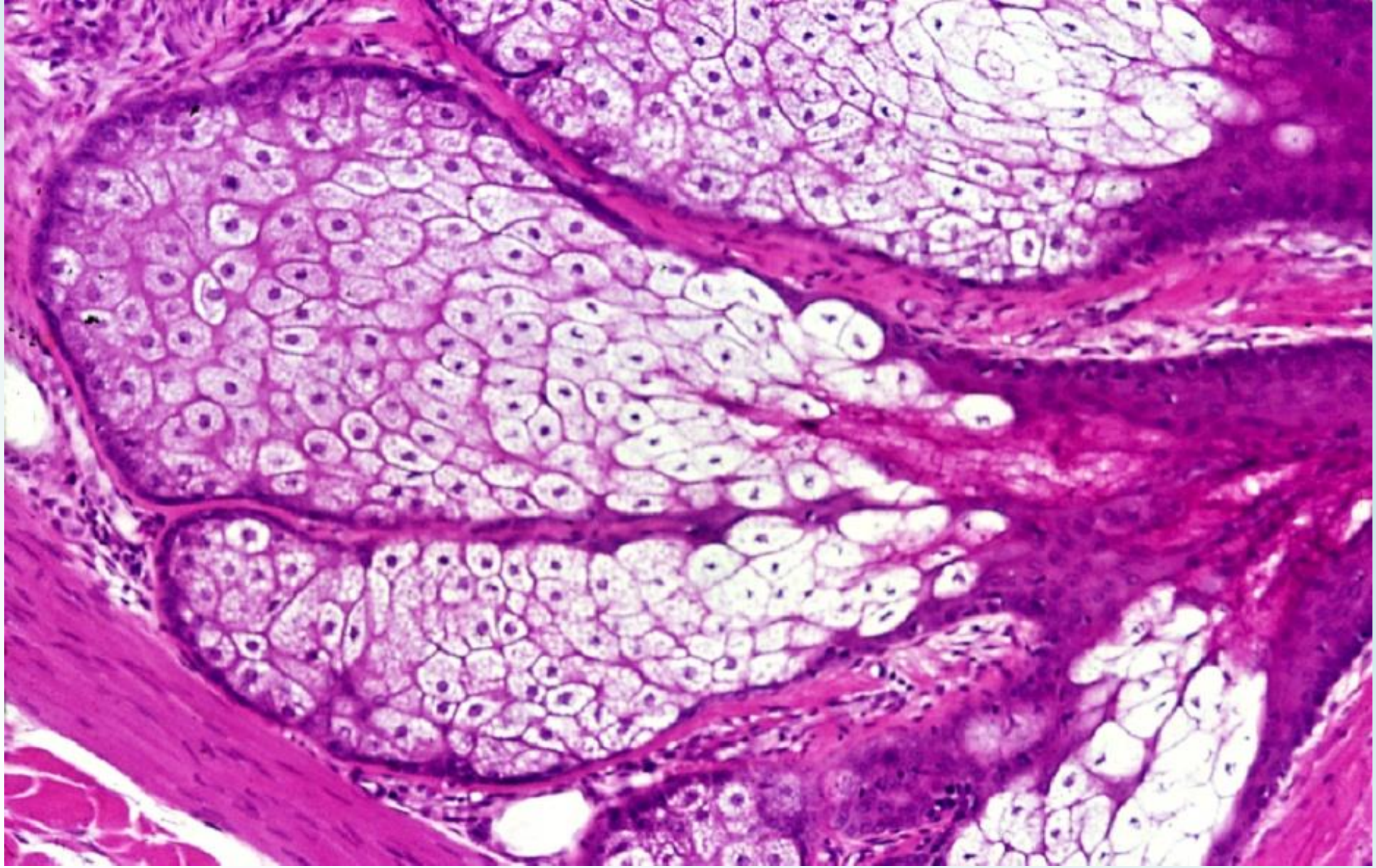
02-37 Apocrine gland. Human, H-E stain, x 100.



02-38 Apocrine gland 2. Human axillar gland. H-E stain, x 66.



02-39 Holocrine gland 1. Human Meibom gland, H-E stain, x 100.



02-40 Holocrine gland 2. Human sebaceous glands of the scalp, H-E stain, x 30.

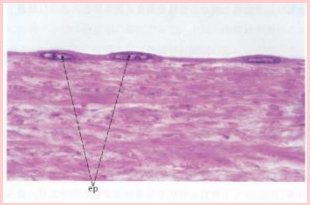
02-00 Epithelium and Glands

- Living beings consists of immense number of cells, of different form and largeness; they are not aggregated randomly but arranged under an order very properly. Cells of distinct shape are associated with each other and with extracellular components constitute four basic tissues, specialized for different functions: epithelium, supporting tissues, muscle, and nervous tissue. The supporting tissue consists of connective tissue, cartilage, bone, and blood.

02- pithelium

- The epithelium is a membrane-like tissue, covering the body surface and the inside of cavity within the body. The epithelium limits the body from the outside and is the site where the materials as well as information are exchanged between the inside and outside of the body.
- The epithelium consists exclusively of cells and contains very few extracellular elements. The epithelium has essentially two faces: a free surface, facing outside or inner cavity, and a basal surface toward the inside, resting on a continuous meshwork of fine filaments, basal lamina.
- The epithelium is classified according to the number of cell layers.
  (1) Simple epithelium.
  This is the simplest form of epithelium, consisting of single layer of identical cells, resting on the basal lamina. According to the cell form four types are described:
  a) Simple squamous epithelium.
  b) Simple cuboidal epithelium.
  c) Simple columnar epithelium.
  d) Ppseudstratified columnar epithelium.
  (2) Stratified epithelium.
  This type of the epithelium consists of multiple layers of cells and three types are described:
  a) Stratified squamous epithelium.
  b) Stratified columnar epithelium.
  c) Transitional epithelium

02-01 Simple squamous epithelium 1.
Serosa of human spleen, H-E stain, x 400.

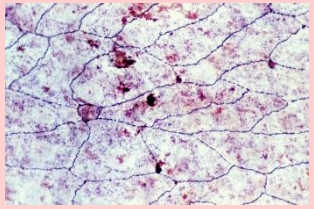


- The cells are flattened to form a very thin squamous epithelium, which covers the thick capsula fibrosa of spleen, densely constituted of collagenous fibers.

02-02 Simple squamous epithelium 2.
Serosa of human spleen, M-G stain, x 400.

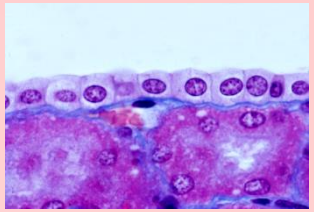
- With M-G stain collagenous fibers appear green so that differentiation between collagenous elements and epitheliar cells is very distinct. Arrows indicate the adherent point between two cells.

02-03 Simple squamous epithelium 3. Mesenterium of frog, silver impregnation, x 160.



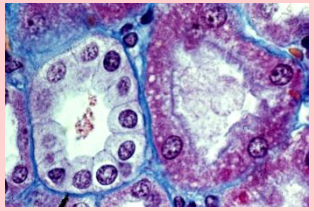
- The spread mesenterium is treated with silver nitrate and then reduced with formalin. The adherent line between the simple squamous epitheliar cells is blackened.

02-04 Simple cuboidal epithelium 1. Collecting tubule of human kidney, longitudinal section, Mallory-Crossmon stain, x 400.



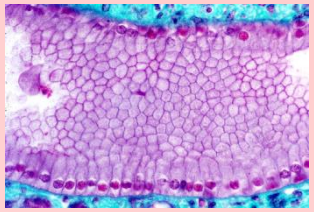
- In this epithelium each cell has practically the same height and width. The limits of cells are distinct and the lining basement membrane stains blue conspicuously. Each cell has free surface facing the lumen and basal plane attaching to the basement membrane. The lower half of this figure occupy two sections of proximal convoluted duct stained deep red; they are also encircled with basement membrane.

02-05 Simple cuboidal epithelium 2. Collecting tubule of human kidney, transverse section, Mallory-Crossmon stain, x 400.



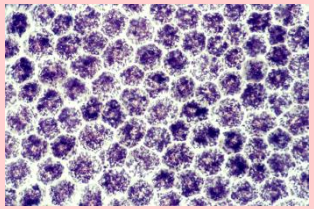
- The transverse section of a collecting tubule (left) and that of proximal convoluted duct (right) are shown. The wall of the collecting tubule consists of simple cuboidal epithelium, showing very clear cell limit and pale cytoplasm, whereas that of the proximal convoluted duct is constituted with also simple cuboudal cells, showing deeply red stained cytoplasm but no cell limit. They are both encircled with distinct basement membrane.

02-06 Simple cuboidal epithelium 3. Collecting tubule of monkey kidney, M-G stain, x 160.



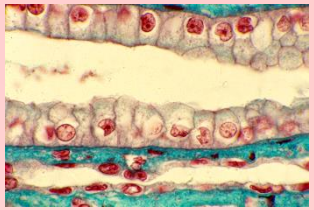
- This is the longitudinal section of a collecting tubule near the inner surface. The lowermost row of the epitheliar cells are tall columnar in form; and middle portion of this figure, cells are cut tangentially, so that cell limits appear polyhedral in form. The surrounding connective tissue stains green.

02-07 Simple cuboidal epithelium 4. Pigment epithelium of bovine retina, not stained, x 160.



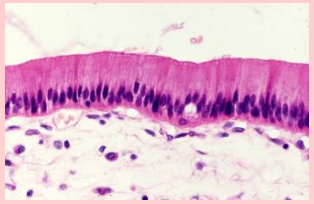
- This is the surface view of the pigment epithelium of bovine retina. Each epitheliar cell shows the hexagonal limit, the clear line. The cytoplasm is filled with dark brown pigment granules.

02-08 Simple squamous and simple columnar epithelia. Human kidney, M-G stain, x 160.



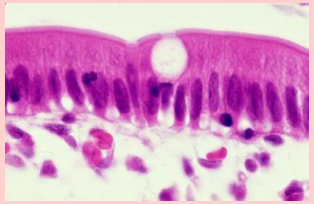
- In the lower portion of the figure there is a thin limb of the loop of Henle, consisting of a simple squamous epithelium. The upper portion of the figure occupies a collecting tubule, consisting of a simple cuboidal or columnar epithelium with distinct cell limits. These are both surrounded by green stained connective tissue.

02-09 Simple columnar epithelium 1. Monkey gallbladder, H-E stain, x 160.



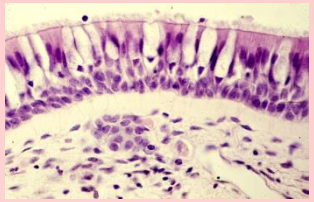
- The epithelium of the gallbladder consists of a single layer of tall columnar cells, with long oval nuclei located toward the base of the cells. The cytoplasm stains with eosin bright pink. The cells are arranged on the conspicuous basement membrane. Beneath the epithelium there fills a very loose connective tissue.

02-10 Simple columnar epithelium 2. Human jejunum, H-E stain, x 400.



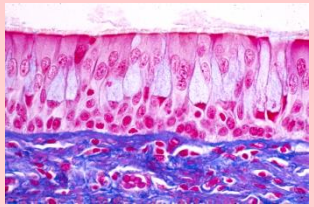
- This is the simple columnar epithelium of the human jejunum, consisting of tall columnar cells. On the free surface, cells have distinct striated border, the characteristic of the absorptive function. Beneath this border there is a conspicuous refractive line , called the terminal bar. The cells have long oval nuclei located toward the base of the cells. The basal plane adheres to the distinct basement membrane and between the lower portion of each cell a narrow gap is noted. The underlying connective tissue is quite loose.
- In the middle of figure there is a cell with a oval blank in the supranuclear (apical) region. This is the goblet cell, secreting the mucous substance. The oval blank is the stored secretion. After discharge of the secretion the cell becomes slender in shape, as indicated with an arrow. Because goblet cells have no striated border, free surface of them sink from the epitheliar surface.

02-11 Pseudostratified ciliated columunar epithelium 1. Human nasal cavity, H-E stain, x 160.



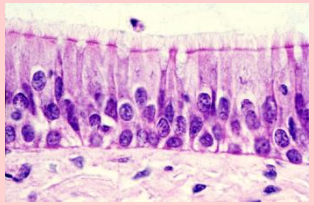
- In the pseudostratified columnar epithelium the nuclei line at several levels and cells are quite different in shape: some are attached to the underlying basement membrane but do not extend to the free surface; these cells are overlaid by tall superficial cells which attain basement membrane with slender processes. Thus the epithelium gives the appearance of a stratified epithelium.
- This figure is the pseudostratified ciliated epithelium of nasal cavity, containing very numerous goblet cells. Epitheliar cells provide numerous motile hairs, cilia, on the free surface, with distinct terminal bar. A very thick conspicuous basement membrane (indicated with arrows) underlies this epithelium.

02-12 Pseudostratified ciliated columunar epithelium 2. Human trachea, Azan stain, x 160.



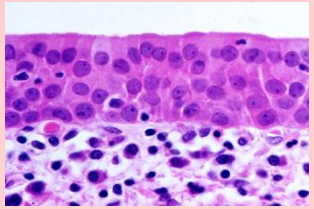
- The general feature of the epithelium is the same as in 02-11, but in this specimen we can see the detail more precisely. The mucous substance in the goblet cells stains lightly blue. Nuclei of cells stain red and the basement membrane and connective tissue stain deep blue.

02-13 Pseudostratified ciliated columunar epithelium 3. Human nasal cavity, H-E stain, x 250.



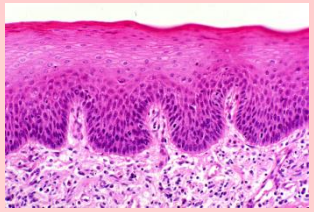
- Because of thinness of the specimen detail of the pseudostratified ciliated columnar epithelium is clearly seen. On the free surface, cilia and terminal bar are very conspicuous but the goblet cells are less clearly noted.

02-14 Stratified columnar epithelium. Human conjunctiva, H-E stain, x 250.



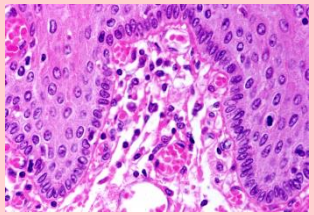
- The cells of deeper layers are polyhedral in shape and not attain to the free surface. The superficial cells are, on the contrary, tall columnar in shape and are not connected with the basement membrane. This type of epithelium seldom occurs in our body, except for the conjunctiva.
- This figure shows the epithelium of human eyelid, a typical stratified columnar epithelium. The basal cells are connected with underlying connective tissue, via basement membrane, The superficial cells are tall columnar and cells of intervening layers are polyhedral in shape.

02-15 Stratified squamous epithelium 1. Human tongue, H-E stain, x 66.



- This figure shows the perpendicular section of the stratified squamous epithelium of human oral cavity. The epithelium is thick and consists of numerous layers of epitheliar cells. The cells of the lowermost layer, next to the underlying connective tissue, are cuboidal or columnar in shape, and arranged perpendicular to the base- ment membrane. Then follow a varying number of layers of irregularly polyhedral cells. The nearer to the free surface, the more the cells are flattened. The superficial layers consist of thin squamous cells.
- In case of thick epithelia, the underlying connective tissue sends numerous processes with capillary vessels, in shape of fingertip, into the epithelium, that are papillae, which supply the nutriment to the superficial cells. In this figure three papillae are seen. The loose connective tissue is underlying the epithelium.

02-16 Stratified squamous epithelium 2. Human tongue, H-E stain, x 160.

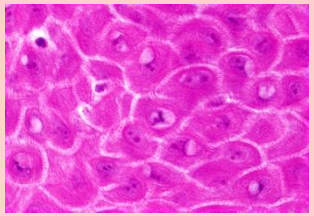


- A typical papilla is shown. The lowermost cells of epithelium are arranged perpen- dicular to the underlying basement membrane, with which numerous capillaries are attached. The loose connective tissue fills the inside of papilla.

02-17 Stratified squamous epithelium, papilla. Human tongue, silver impregnation, x 160.

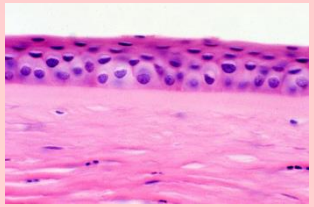
- The same specimen as 02-16, but impregnated with silver. The basement membrane, consisting of reticular fibers, is blackened. The perpendicular arrangement of the lowermost cells of the epithelium is clear. This specimen is counterstained with Kernechtrot.

02-18 Stratified squamous epithelium, intercellular bridges. Human tongue, H-E stain, x 250.



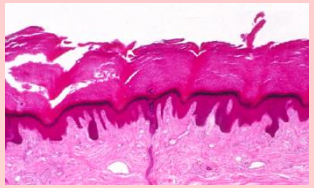
- Between the polyhedral cells of the stratified squamous epithelium, there are gaps, which make possible to flow the nutriment, exuded from the capillary. Across the gaps a number of very thin processes connect the cells each other; these are called intercellular bridges.

02-19 Stratified squamous epithelium. Human cornea, not keratinized, H-E stain, x 160.



- Stratified squamous epithelium of cornea consists of several layers of cells. The lowermost cells are cuboidal with rounded top and arranged on a very thick basement membrane (Bowman's membrane). Then follow only two or three layers of polyhedral cells and attain the superficial flattened cells, which keep still nuclei, not keratinized. Beneath the Bowman's capsule is the dense connective tissue, stroma corneae.

02-20 Stratified squamous epithelium with keratinization. Human thumb-tip, H-Estain, x 64.

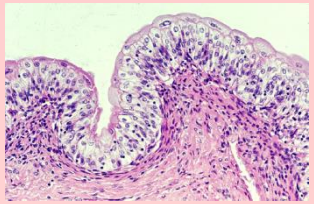


- The epithelium of the skin, epidermis, covering the whole body surface is the stratified squamous epithelium with keratinization. This is the skin of the thumb-tip, consisting of very thick epidermis. Cells of superficial layers lose their nuclei and the cytoplasm is largely replaced by the screloprotein, keratin. The cells become dry, devitalized scales. Such an epithelium is called a keratinized stratified squamous epithelium. In this figure the keratinized cell layer occupies about 2/3 of epidermis.

02-21 Stratified squamous epithelium with keratinization 2. Human palm, H-E stain, x 25.

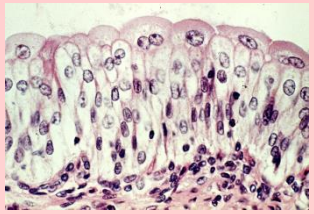
- This is the perpendicular section of the human palm. The epidermis is very thick, about 0.3～0.6 mm in thickness. The epidermis consists of 5 layers, very regularly arranged from the bottom to the surface:
① Stratum basale. This is the lowermost layer, consisting of a single layer of cuboidal or low columnar cells. with basophilic cytoplasm and arranged perpendicular to the underlying basement membrane. Mitotic figures are common in this layer.
② Stratum spinosum. This layer is composed of 5~15 layers of irregularly polyhedral cells, becoming gradually flattened toward the surface. In this layer intercellular gaps and intercellular bridges are very conspicuous.
Str. basale and str. spinosum are called together stratum germinativum.
③ Stratum granulosum. This layer cconsists of 3 to 5 layers of cells, containing keratohyalin granules, the precursor of keratin. These granules stain intensely dark blue with hematoxylin. The amount of the granule increases greatly in the upper flattened cells.
④ Stratum lucidum. This is a thin, lightly staining and refractile layer, consisting of 4 to 6 row of very flagttened cells. Their nuclei are not perceivable.
Str. granulosum and str. lucidum are called together str. intermedium.
⑤ Stratum corneum. This layer consists of many layers of very flat, heavily keratinized cells containing no nuclei nor endoplasmic organelles.

02-22 Transitional epithelium 1. Human urinary bladder, H-E stain, x 64.



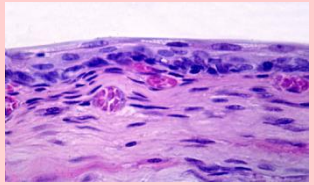
- This epithelium occurs in the renal calyces, pelvis, ureter and urinary bladder.
- The urinary bladder changes in volume greatly with filling and emptying of the urine. The appearance of this epithelium in histological sections varies between stratified columnar and stratified squamous epithelium depending on its degree of distention.
- This figure shows the epithelium of the medium-distended bladder. It consists of several layers of cells; the lowermost cells attaching to the basement membrane are cuboidal or columnar in shape and arranged perpendicular to the basement membrane; cells of the following layers are columnar or polyhedral in shape and the superficial layer consists of large cells with a convex free surface; among them some are binucleated.

02-23 Transitional epithelium 2. Human urinary bladder, H-E stain, x160.



- This figure shows the epithelium of the highly contracted bladder, just after urination. The epithelium consists of several layers of cells: except for the superficial cells, that are large and with rounded free surface, cells of lower layers are all tall columnar in shape and arranged perpendicular to the basement membrane.

02-24 Transitional epithelium 3. Human urinary bladder, H-E stain, x 200.

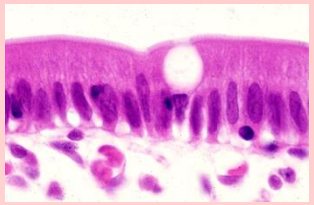


- This shows the epithelium of an extremely distended bladder, consisting of only two or three layers of flattened squamous cells.

02- lands

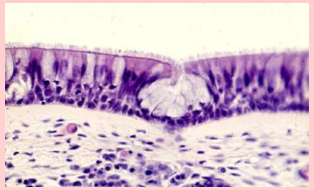
- The function of cells to synthesize the high molecular substances inside of the cells and to release them outside as the cellular products is called **secretion**. Organs composed of cells, specialized for the secretion, are called **glands**. The cells constituting glands are named glandular cells.
- The glands are classified with respect to their mode of secretion:
  1) **exocrine glands,** which discharge their product directly at the free surface or via conducting duct system at a fixed place;
  2) **endocrine glands**, which release their product into the blood or lymph vessels. This type of glands is called glands without ducts (glandulae sine ductibus).
- The exocrine glands are further classified: ① merocrine(eccrine) glands, ② apocrine glands, and ③ holocrine gands,
- The exocrine glands consists of secretory portions and ducts.

02-25 Unicellular gland. Human intestinal epithelium, H-E stain, x 400.



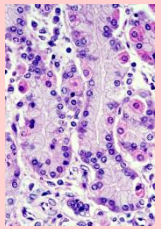
- The unicellular gland consists of only one secretory cell, that is the goblet cell in the intestinal epithelium. This figure shows two goblet cells, one containing mucus in the supranuclear (apical) portion (large arrow) and the other empty of mucus (small arrow). The goblet cell has no striated border so that its free surface sinks from the surface of the intestinar epithelium, with striated border.

02-26 Multicellular intraepitheliar gland. Human nasal mucosa, H-E stain, x 100.



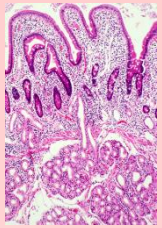
- This type of gland occurs seldom in the nasal, phalyngeal and laryngeal mucosa and consists of several goblet cells surrounding a common hollow. This figure shows a multicellular intraepitheliar gland found in the nasal mucosa, constituted by pseudostratified ciliated columnar epithelium containing numerous goblet cells.

02-27 Tubular glands. Human gastric glands, H-E stain, x 160.



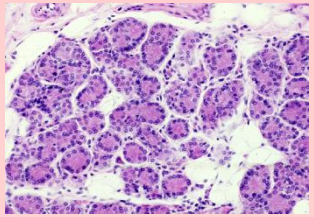
- The multicellular glands start from the epitheliar surface into the underlying connective tissue as invaginations; the blind terminal portion differentiates to the secretory portion and tubular portion connecting the terminal portion and epitheliar surface becomes the duct. According to the form of secretory portions the glands are classified into the tubular and alveolar glands. Secretory portions and ducts are both surrounded by the connective tissue.
- In this figure two long tubular glands with very narrow lumen are shown; these are gastric glands.

02-28 Alveolar glands. Human duodenal glands, H-E stain, x 25.



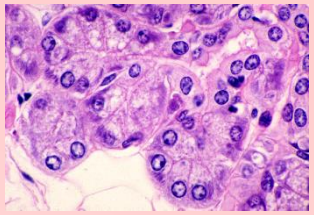
- The glands, whose secretory portions have wide lumen, are called alveolar glands. The duodenal glands start at the bottom of the intestinal glands and in the tela submucosa the secretory portion branches repeatedly to form a complex glands.
- This figure shows the duodenal glands, typical alveolar glands.

02-29 Serous glands 1. Human lingual gland, H-E stain, x 64.



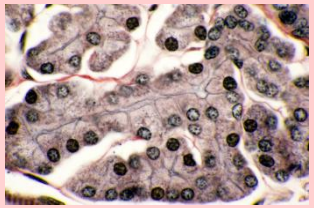
- The glands, whose secretion is watery light, not viscous and contains water-soluble protein, mainly enzymes, are called serous glands. The secretory portions, acini, consist of several number of tall trapezoid cells surrounding a very narrow lumen. The cytoplasm stains intensely with basic dye and contains in the apical portion numerous secretion granules. The nucleus is round and locates in the basal region of the cell.
- This figure shows a portion of human small salivary gland, constituted by numerous acini surrounded by loose connective tissue. In each acinus the lumen is perceived with difficulty. The cytoplasm surrounding the lumen appears reddish, because of the richness of the secretion granules. The round nuclei line up in the basal region of cells.

02-30 Serous glands 2. Human submandibular gland. H-E stain, x 250.



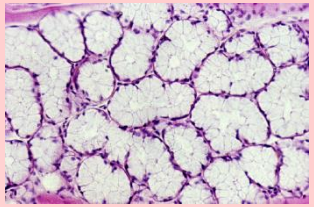
- This is the serous secretory portion of human submandibular gland showing the acinar lumen and intercellular secretory canaliculi. In this figure basophilic (blue-violet) hue of the cytoplasm is conspicuous. In the upper right corner is an inter- calated duct (ID) and its lumen continues left downward into an acinus, sending some intercellular secretory canaliculi (arrows).

02-31 Serous gland 3. Rabbit, Heidenhain' iron-hematoxylin stain, x 250.



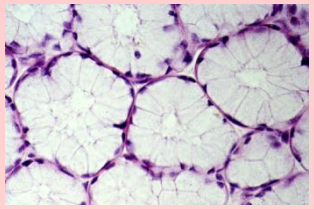
- This is a longitudinally cut acinus of rabbit lingual gland, stained with Heidenhain's iron-hematoxylin. In the middle a narrow and long lumen appears in the axial region of the acinus. From this lumen branch the intercellular secretory canaliculi (arrows), coinciding with the cell boundary.
- This preparation was made by Prof. Dr. M. Heidehhain (1864～1949), inventor of this stain, by himself, in 1912.

02-32 Mucous gland 1.Monkey, H-E stain, x 64.



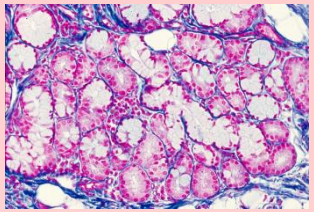
- The mucous glands secrete mucus containing mucin. The acinus consists of cuboidal or columnar cells surrounding a wide lumen. The cytoplasm of acinar cells appear pale and clear and the nucleus is flattened and pressed against the basis of the cell.
- This is the mucous gland in human tongue.

02-33 Mucous gland 2. Monkey, H-E stain, x 160.



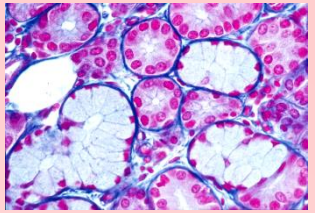
- This is higher magnification of 02-32. The details of the mucous gland are clearly seen. The acini are enveloped by the loose connective tissue.

02-34 Mixed gland 1. Cat tracheal gland, Azan stain, x 63.



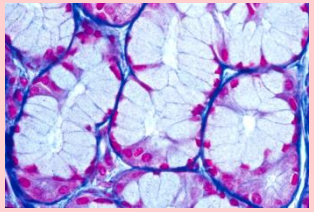
- The glands consisting of both serous and mucous acini are called the mixed glands.
- This figure shows a typical mixed gland, found in the cat trachea. A group consisting of serous and mucous acini, lobulus, surrounded by interlobular connective tissue (blue). By Azan stain the nuclei appear red, the cytoplasm of serous acinar cells reddish, and that of mucous acinar cells pale blue.
- This preparation was also made by Prof. Dr. M. Heidenhain (1864～1949), inventor of this stain, by himself, in 1929.

02-35 Mixed gland 2. Cat tracheal gland, Azan stain, x 160.



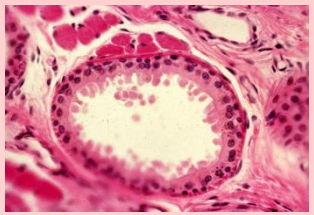
- This is higher magnification of 02-34. The details of serous (S) and mucous (M) acinar cells are very precisely observed. Note the blue-ish hue of the mucous acinar cells. An arrow indicates a dumilune (DL).

02-36 Mixed gland 3. Dumilunes. Cat tracheal gland, Azan stain, x 160.



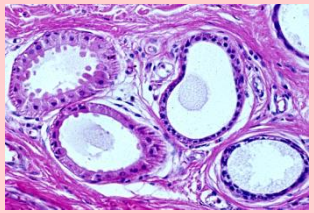
- This is also higher magnification of 02-34. In the mixed glands, small groups of serous acinar cells often attach to the distal end of the mucous acinus; they are called dumilunes. In this figure three mucous acini are sown, each having at their distal end dumilune (arrows).

02-37 Apocrine gland. Human, H-E stain, x 100.



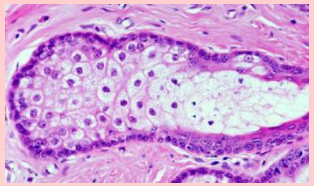
- In some sweat glands, secretion is first accumulated in the apical region of cells that are tall columnar in shape; then the apical portion of cells filled with secretion protrudes into the lumen as a droplet in shape and finally it leaves from the cell surface as a with cell membrane wrapped secretion droplet. After secretion cells become low cuboidal in shape. Such secretion is called the apocrine secretion.
- This figure shows the typical apocrine secretion of human ciliary gland (gland of Moll) in the eyelid.

02-38 Apocrine gland 2. Human axillar gland. H-E stain, x 66.



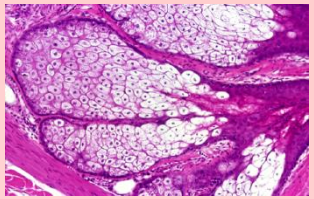
- This is the human axillar gland. There are four sections of glandular lumen; the left two show the typical figure of apocrine secretion and the right two consisting of low cuboidal cells shows the condition just after secretion.

02-39 Holocrine gland 1. Human Meibom gland, H-E stain, x 100.



- This type of glands is seen in the sebaceous glands of skin and in the tarsal glands of Meibom in the eyelid. These glands are long and rounded sacs (alveoli) in shape. The wall of the alveoli is formed by a basement lamina. Along the internal surface is a single layer of thin cells with round nuclei. Toward the center of the alveoli most of cells become larger and polyhedral, gradually fill with fat droplets and resemble multilocular fat cells. The nuclei gradually shrink and then disappear, and the cell breaks down into fatty detritus and finally discharge as the secretion into the duct. This process is called holocrine secretion.
- This figure is an alveolus of human tarsal gland in the eyelid, showing the typical holocrine process.

02-40 Holocrine gland 2. Human sebaceous glands of the scalp, H-E stain, x 30.



- In this figure four alveoli of the sebaceous gland of the human scalp opening into a common duct are shown. In each alveolus the holocrine process is clearly observed. In the lower left region of this figure an arrector pili muscle is seen.