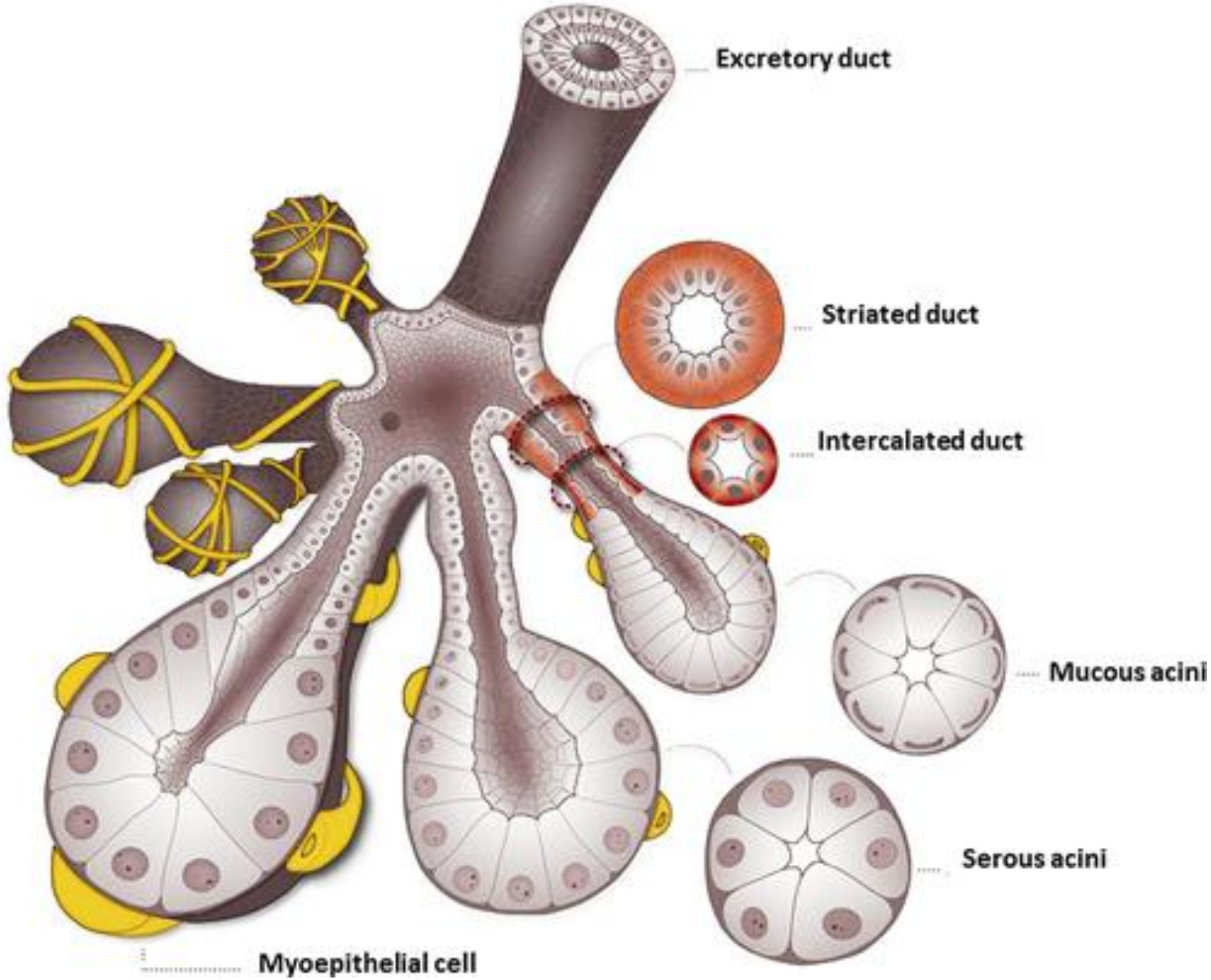
Growth factor production in the striated duct of the major salivary gland

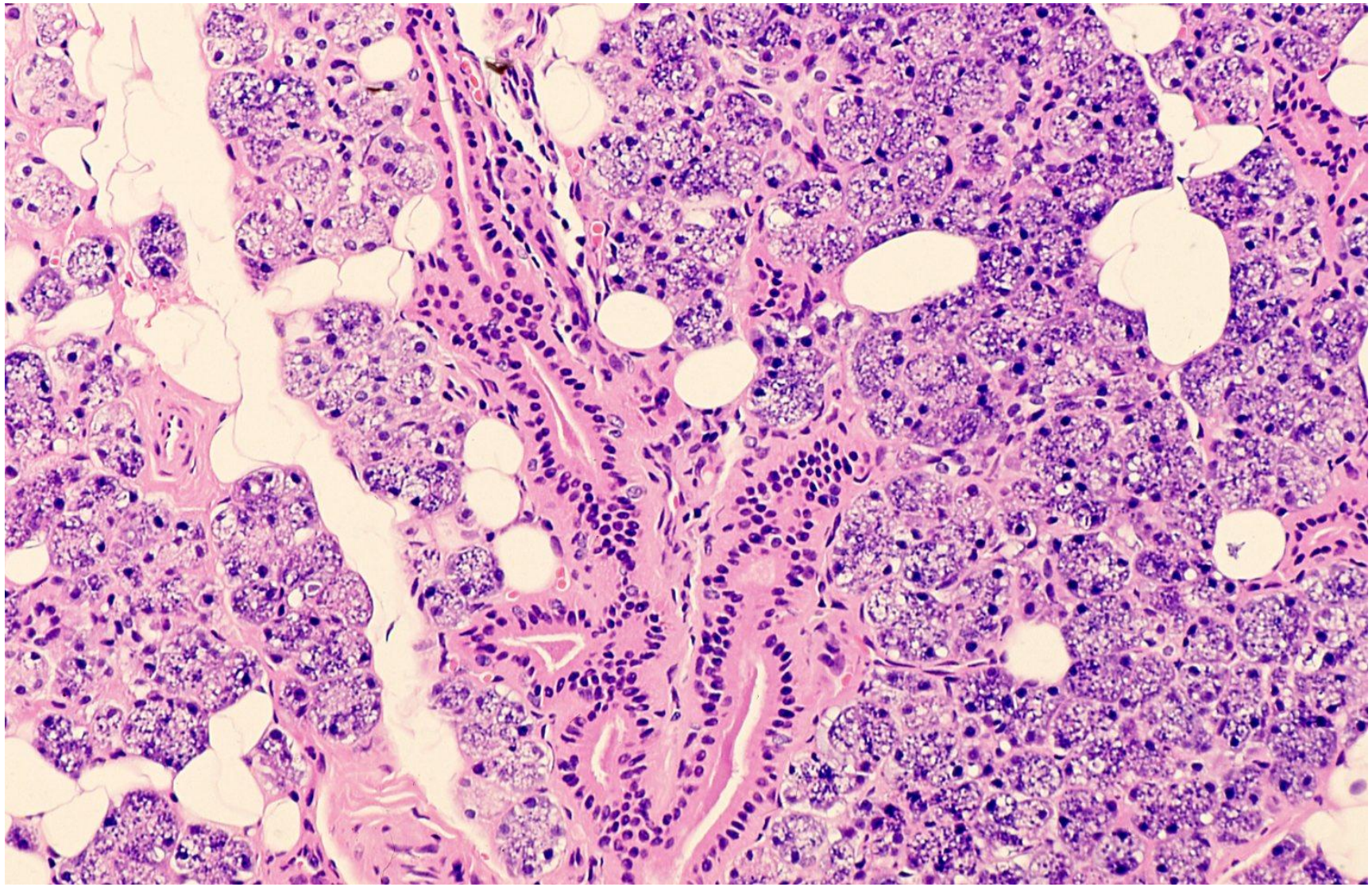
The salivary gland synthesizes and secretes saliva, a multi-functional fluid, providing mucosal lubrication, salivary electrolytes, antibacterial compounds and various enzymes to protect the oral mucosa and teeth surface. Microscopically, it consists of acinar cells and a complex ductal system, associated with contractile myoepithelial cells. Intercalated ducts are directly connected to the acinar cells, showing a simpler wall structure as a single cuboidal epithelial layer. The intercalated ducts are followed by striated ducts, and they are functionally important for performing most of the ion exchange between the initial salivary fluid and the extracellular matrix through several membrane folding (striations) on their basal side. The striated ducts comprise the majority of the ductal system in the major salivary glands as intralobular ducts permeate the glandular lobe. They are specialized in regulating the secretion and reabsorption of electrolytes through a bidirectional transport between the lumen and the extracellular space, promoting the essential salivary modification from isotonic to hypotonic saliva. This process requires cell energy and striated ductal cells therefore present possess a large number of mitochondria along their basolateral membrane in their distinct columnar cytoplasm, characterizing the striated aspect by their multiple folding. It is well known that growth factors, such as epidermal growth factor (EGF), nerve growth factor (NGF), transforming growth factor α and β (TGF-α/β), bone morphogenetic protein (BMP), insulin-like growth factor (IGF), basic fibroblastic growth factor (bFGF) and kallikrein, are produced in striated ducts of the human salivary gland. These growth factors may have a functional role in cell migration, proliferation and maturation in not only salivary glands but also other organs, but their physiological roles remain unclear.

Ref.-1: de Paula F, et al. Overview of human salivary glands: highlights of morphology and developing processes. Anat Rec 2017; 300(7): 1180-1188. doi: 10.1002/ar.23569

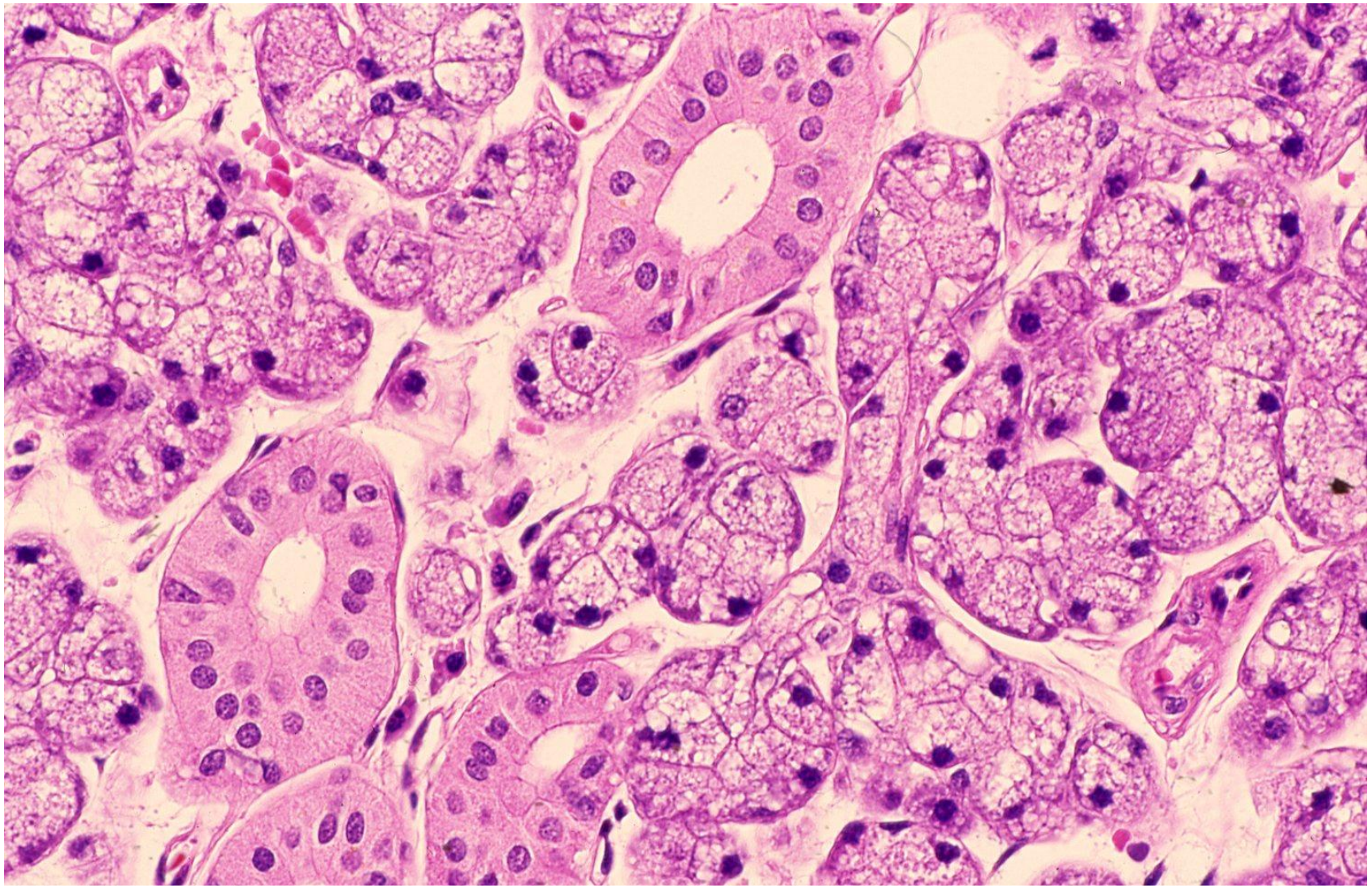
Ref.-2: Mori M, et al. Multifunctional roles of growth factors or biologically active peptides in salivary glands and saliva. Oral Med Pathol 2008; 12(4): 115-123. doi: 10.3353/omp.12.115



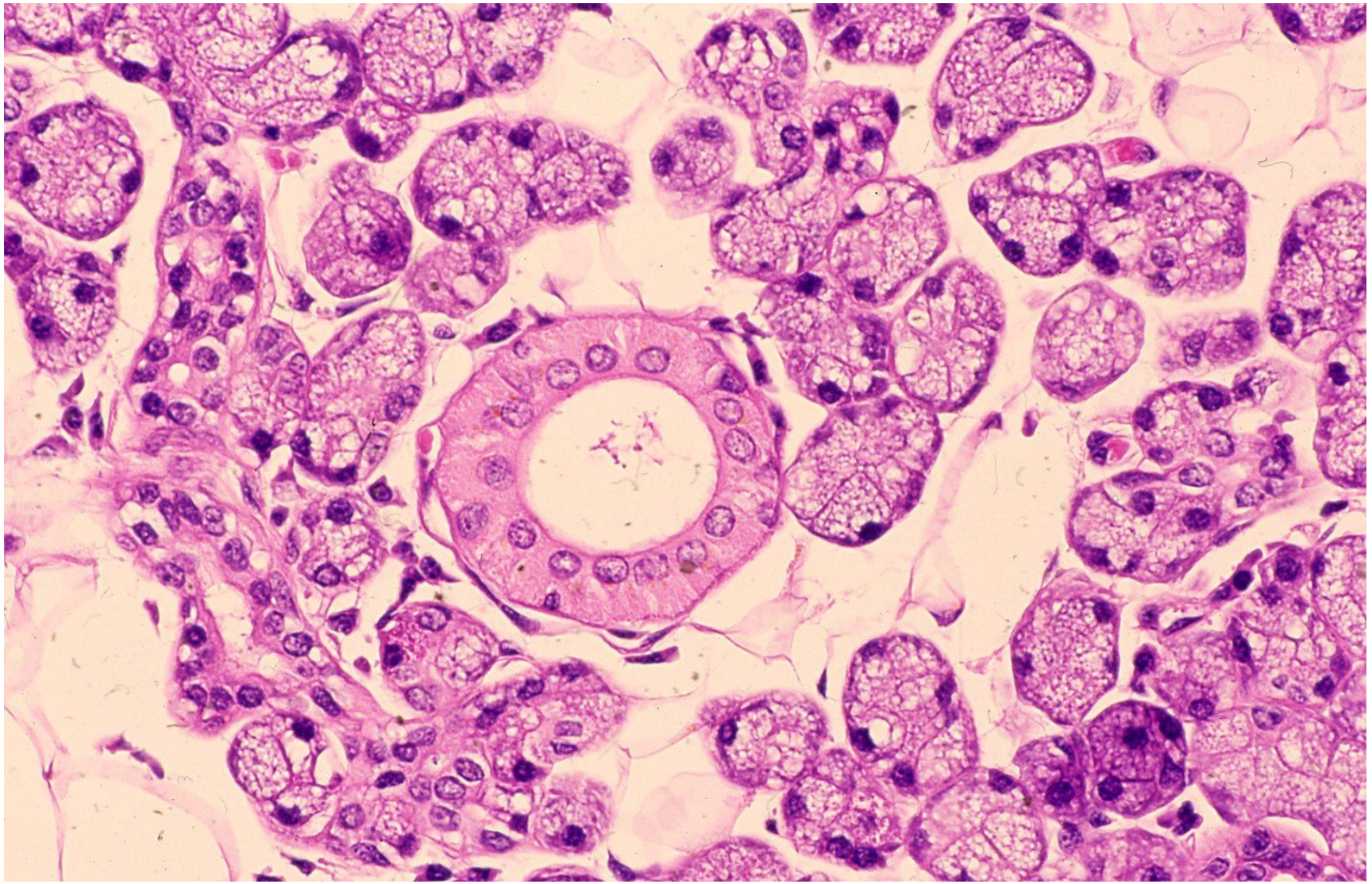
Schematic illustration of the major salivary gland, with particular emphasis on the striated duct



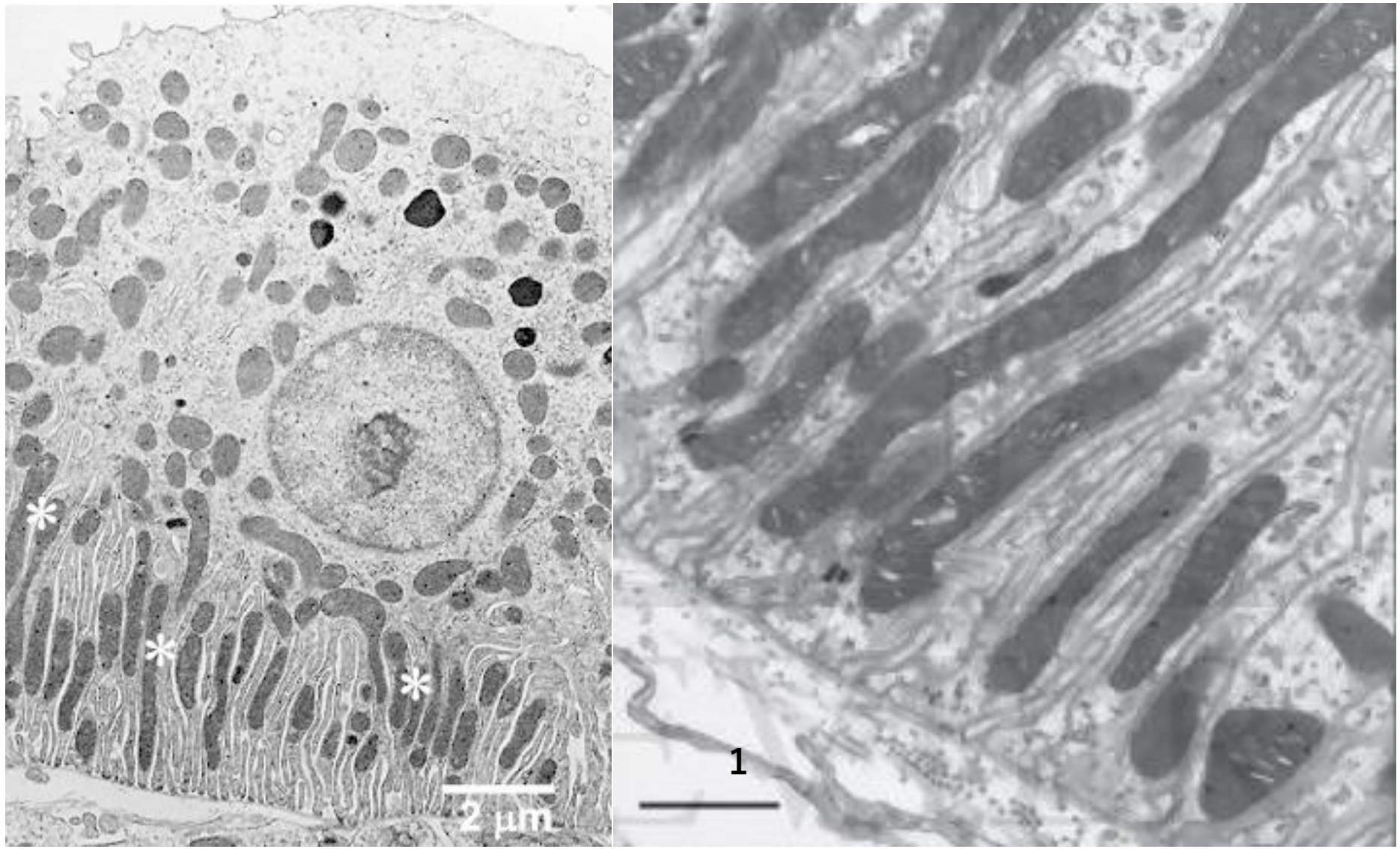
Histology of the parotid gland (H&E-1). Among the acinar cells, the tall columnar duct system termed the striated duct is observed. Eosinophilic plump cytoplasm is noted.



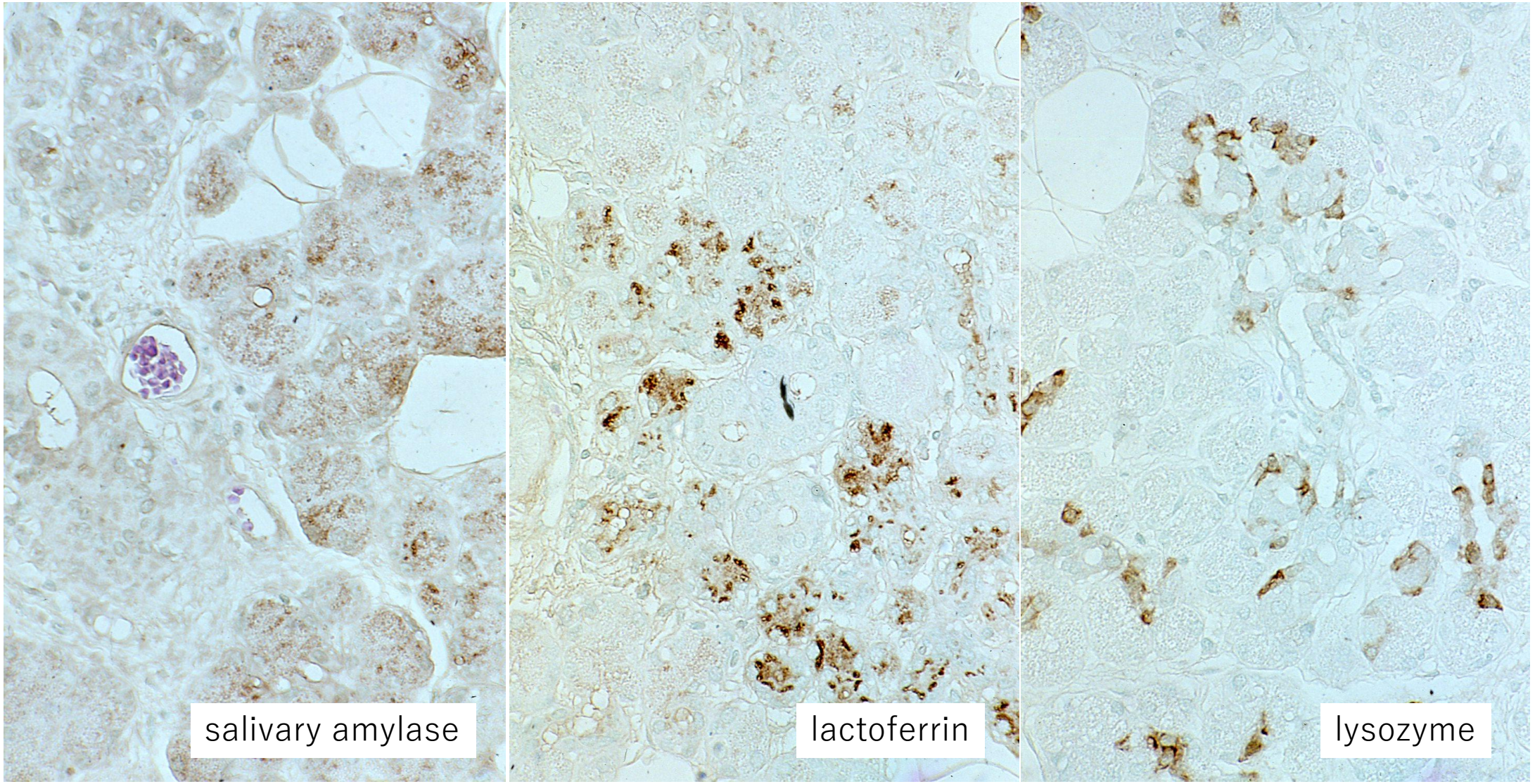
Histology of the parotid gland (H&E-2). Among the acinar cells, the tall columnar duct system termed the striated duct is observed. Eosinophilic plump cytoplasm with longitudinal striation is characteristic.



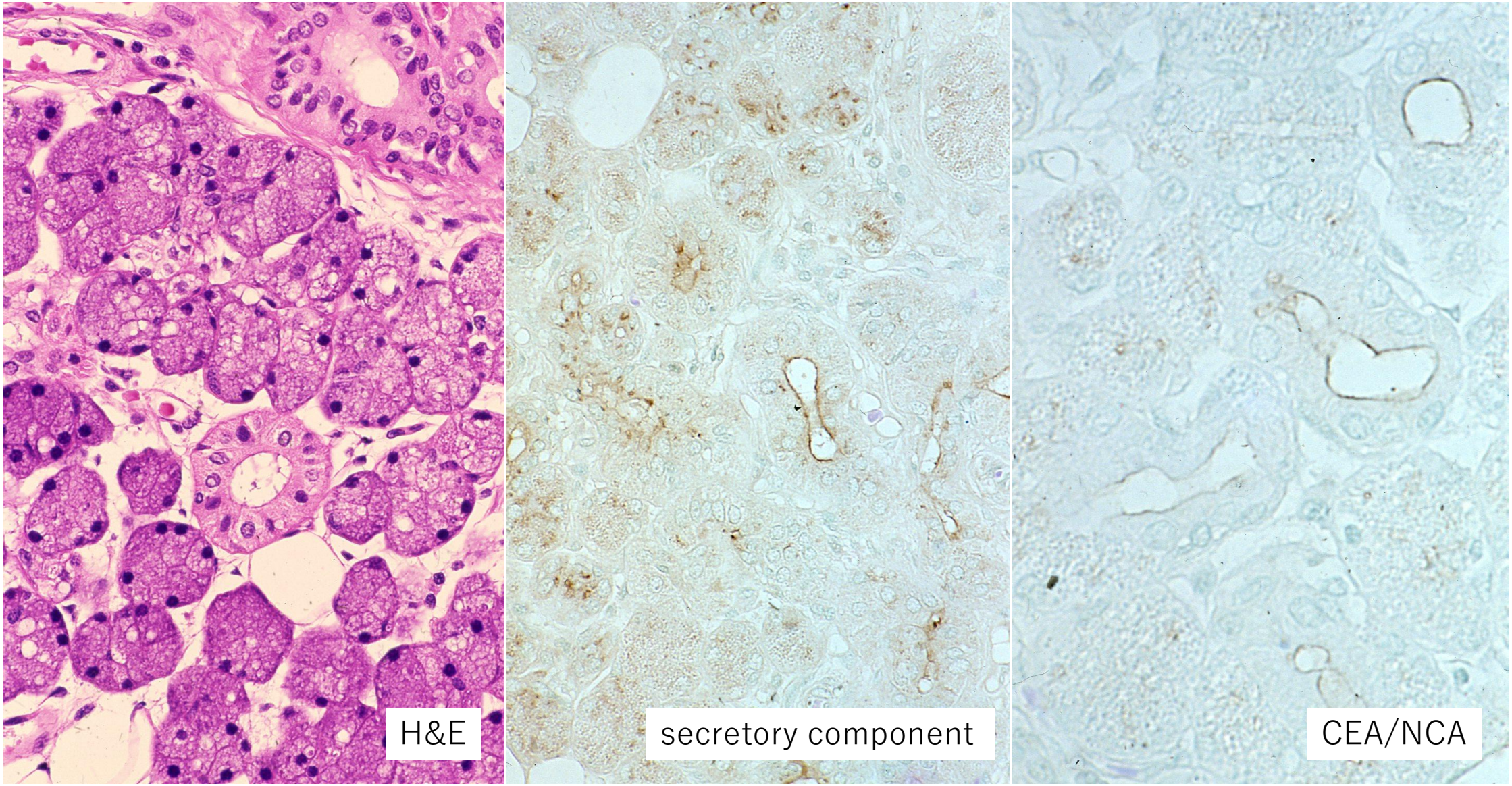
Histology of the parotid gland (H&E-3). Among the acinar cells, the tall columnar duct system termed the striated duct is observed. Eosinophilic plump cytoplasm with longitudinal striation is characteristic.



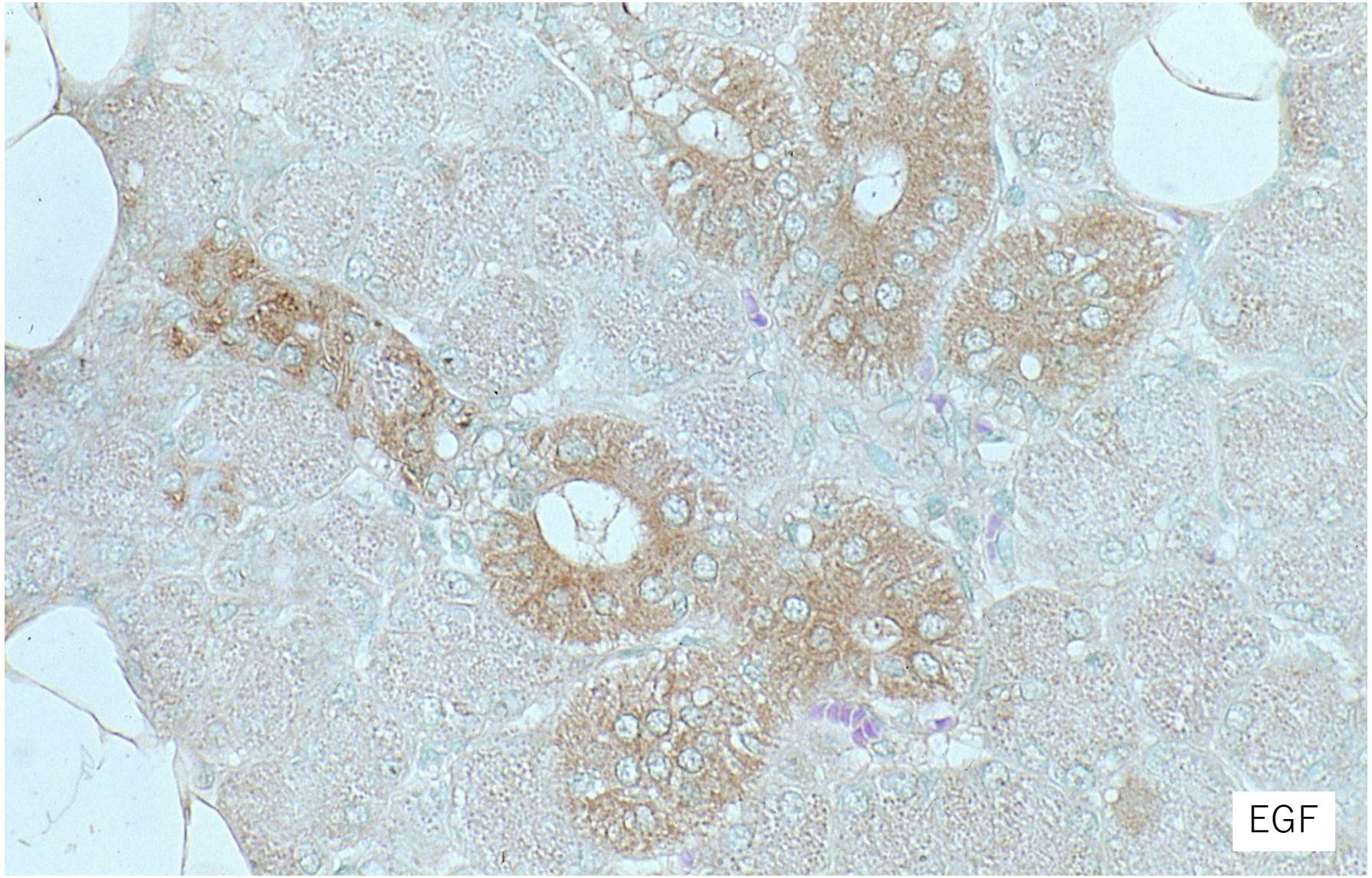
Ultrastructure of the striated duct of the major salivary gland. At the base of the columnar cells, repeated striated foldings of the basal plasma membrane are closely associated with a large number of mitochondria (asterisks) with high electron density (borrowed from the Internet sites)



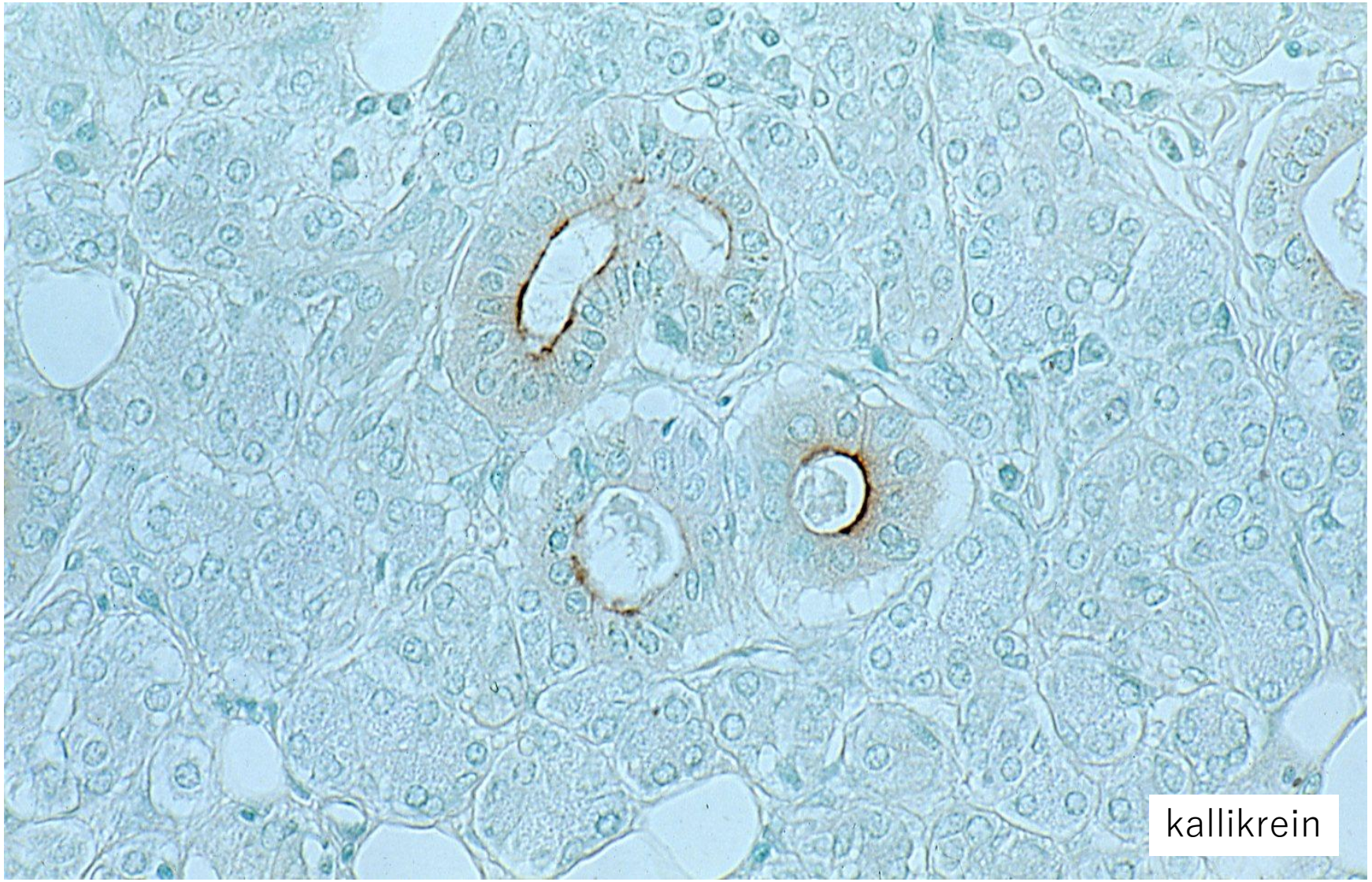
Secretory products of **acinar cells** of the parotid gland. Serous acinar cells in the parotid gland secrete salivary amylase (left), lactoferrin (center) and lysozyme (right).



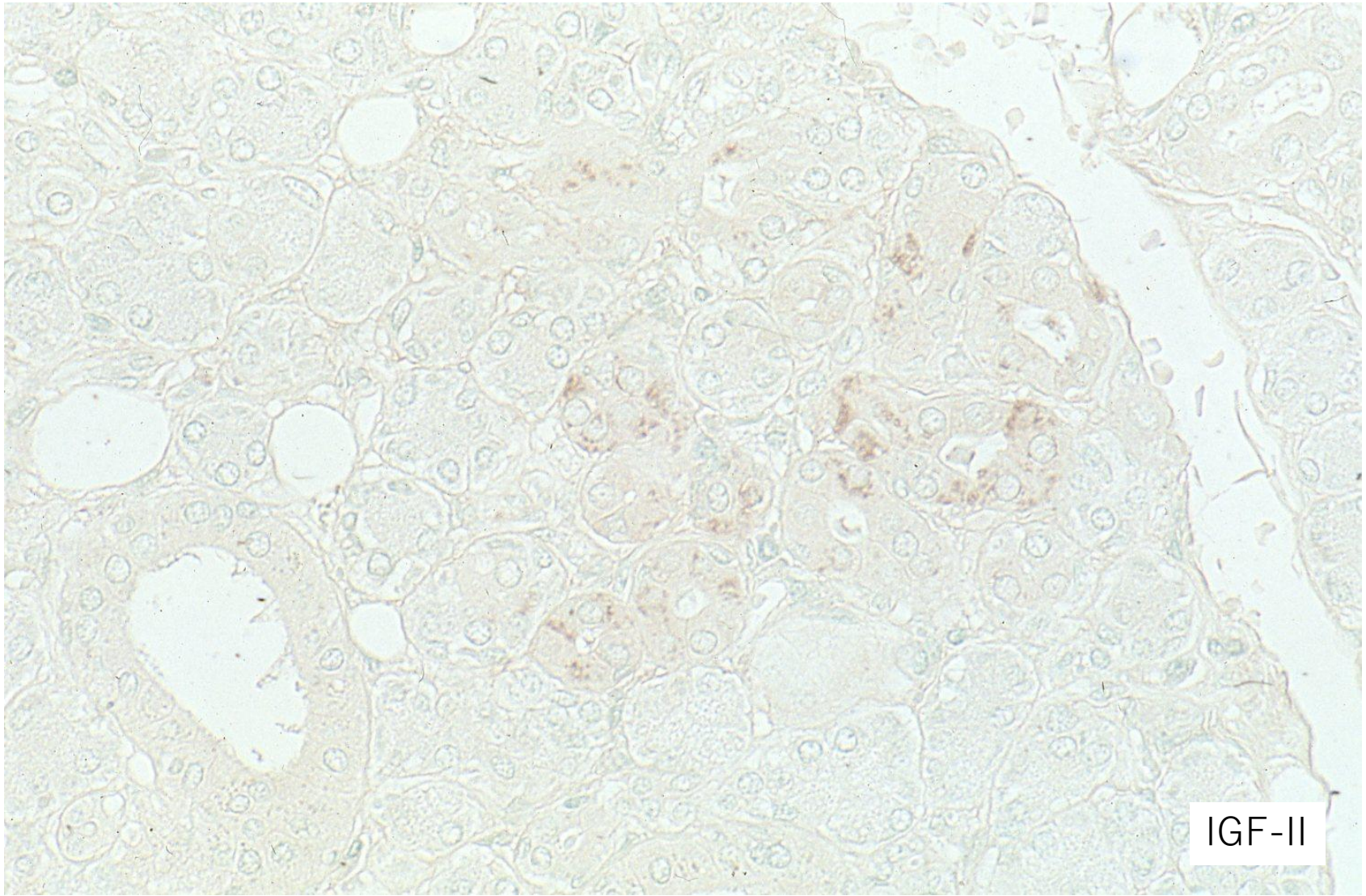
Secretory products of striated ductal cells of the parotid gland (1). Secretory component (SC: center) and CEA/NCA (detected with anti-CEA antiserum: right) are localized on and along the apical plasma membranes. Cytoplasmic granular reactivity of SC is further seen in both the striated ductal cells and acinar cells (left: H&E).



Secretory products of striated ductal cells of the parotid gland (2). The striated ductal cells are immunoreactive for epidermal growth factor (EGF). The cytoplasmic finely granular positivity is seen (immunostaining for EGF).



Secretory products of striated ductal cells of the parotid gland (3). The striated ductal cells are immunoreactive for kallikrein. The cytoplasmic finely granular positivity is observed (immunostaining for EGF). Kallikrein is a serine protease, and bradykinin is produced in the kallikrein-kinin system. Bradykinin induces vasodilatation to lower the blood pressure.



Secretory products of striated ductal cells of the parotid gland (4). The striated ductal cells are immunoreactive for insulin-like growth factor-II (IGF-II). The cytoplasmic finely granular positivity is observed (immunostaining for IGF-II). IGF-II is the major growth factor active in fetal development. For reference, IGF-I functions in adults as an insulin-like growth factor.