

Koilin-like metaplasia (avian-type apoptotic failure) of the cecum

An unpublished, unique metaplastic change seen in the cecal mucosa of an aged lady is described. The flat elevated lesion is composed of koilin membrane-like accumulation of cryptal secretion (rodlets), associated with apoptotic crypt epithelial cells. “Koilin” is formed in the gizzard (specialized stomach) of the bird as a thick and hard membranous structure made of cryptal secretion and apoptotic crypt epithelial cells, to assist at the digestion of food by the toothless bird. The author termed this unique localized mucosal change as koilin-like metaplasia (or avian-type apoptotic failure). Immunohistochemical features of the rodlets are demonstrated for indicating the apoptotic failure within the lesion. For comparison, normal koilin membrane of several kinds of birds is also illustrated.

Ref.-1: Akester AR. Structure of the glandular layer and koilin membrane in the gizzard of the adult domestic fowl (*Gallus gallus domesticus*). *J Anat* 1986; 147: 1-25. PMID: 3693065

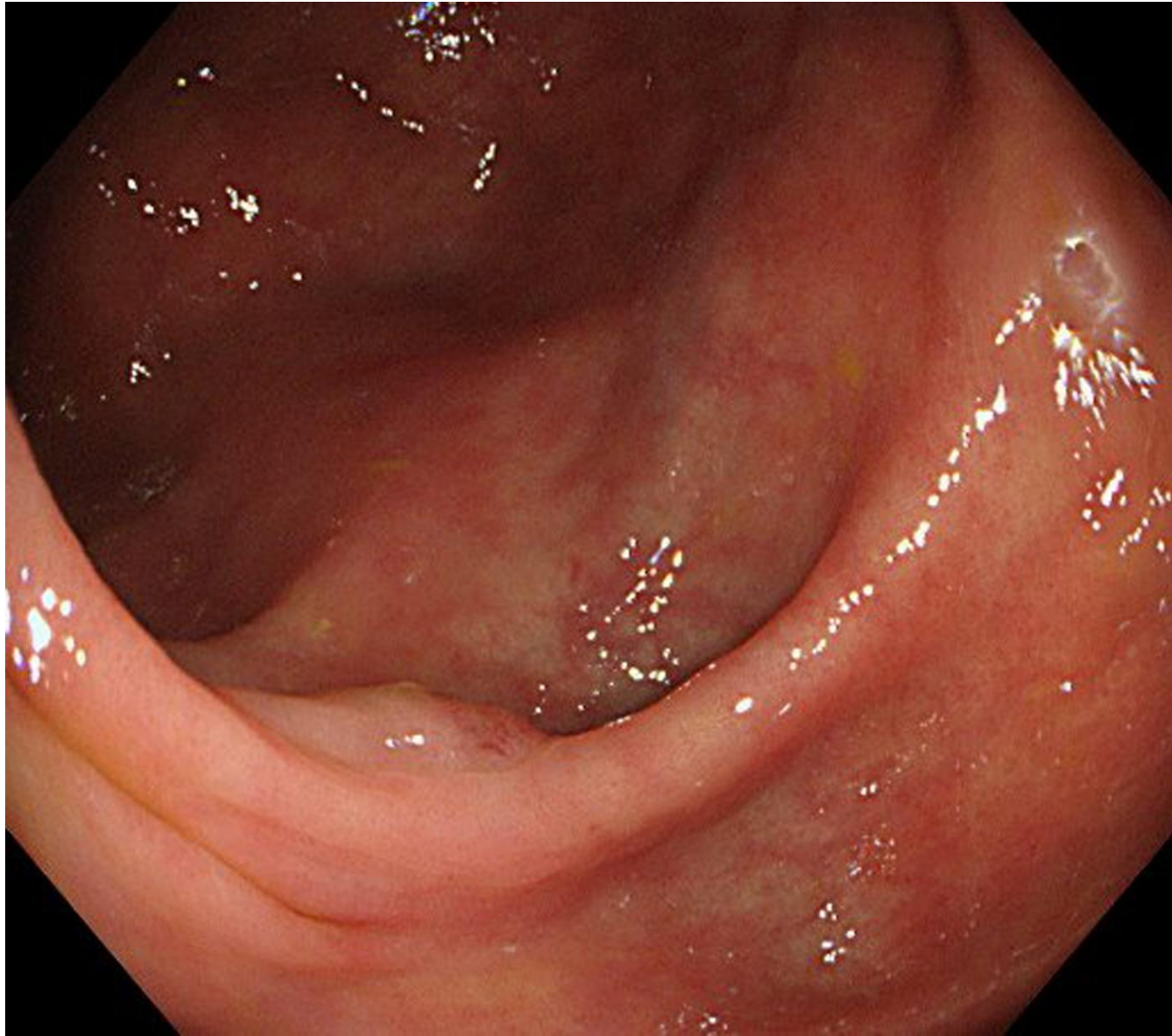
Ref.-2: Kadhim KK, et al. Histomorphology of the stomach, proventriculus and ventriculus of the red jungle fowl. *Anat Histol Embryol* 2011; 40(3): 226-233. doi: 10.1111/j.1439-0264.2010.01058.x

Gizzard and koilin membrane of the bird

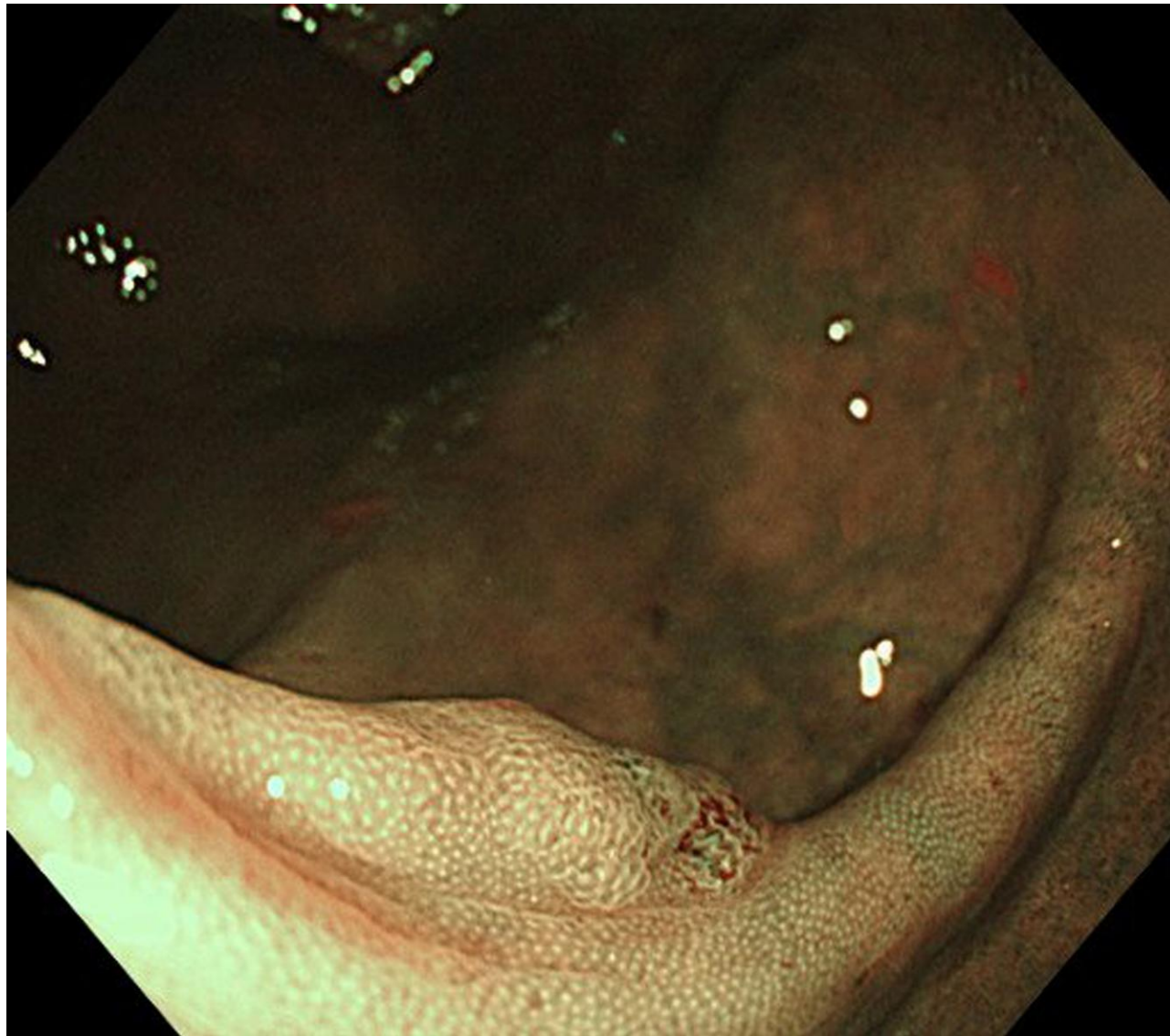
The gizzard, a specialized stomach with thick muscular walls is also called as the ventriculus, gastric mill or gigerium, and it is found in birds, dinosaurs, crocodiles, alligators, earthworms, some gastropods, some fish and some crustaceans. In the mammals, pangolin (scaly anteater) lacks teeth and has a gizzard. All the birds do not have teeth, and their gizzard can grind the food. Some birds swallow small bits of gravel acting as 'teeth' in the gizzard. The gizzard stones break down hard food such as seeds. The gizzard is lined by a thick koilin membrane (gastric cuticle) formed by the secretions (rodlets) of glandular crypts and surface epithelial cells. The rodlets are composed of apoptotic crypt cells and cryptal secretions. The glands and koilin membrane form a continuous layer, and the koilin membrane is made of a carbohydrate-protein complex.

Ref.-1: Svihus B. The gizzard: function, influence of diet structure and effects on nutrient availability. World's Poultry Sci J 2011; 67(2): 207-224. doi:10.1017/S0043933911000249

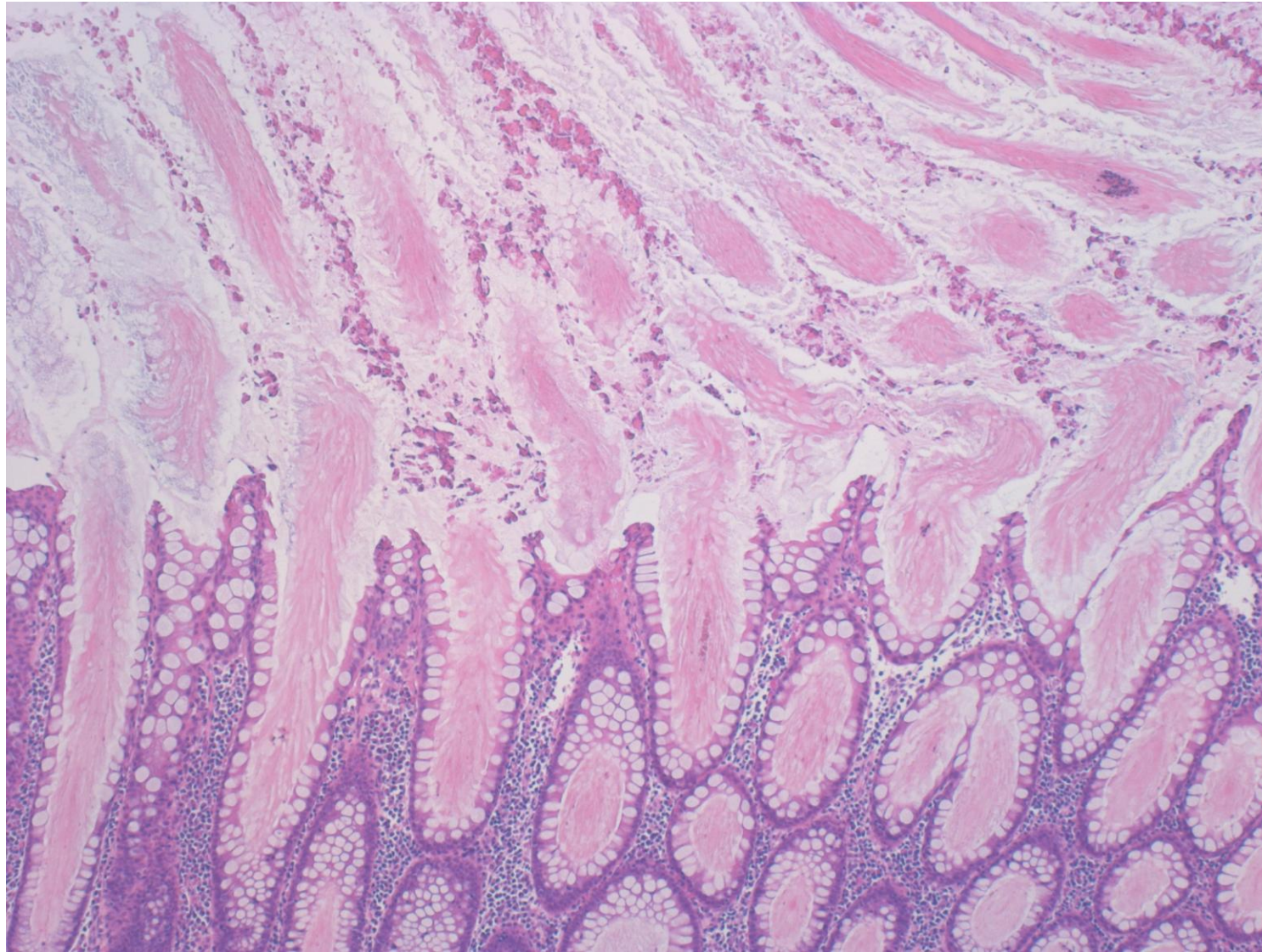
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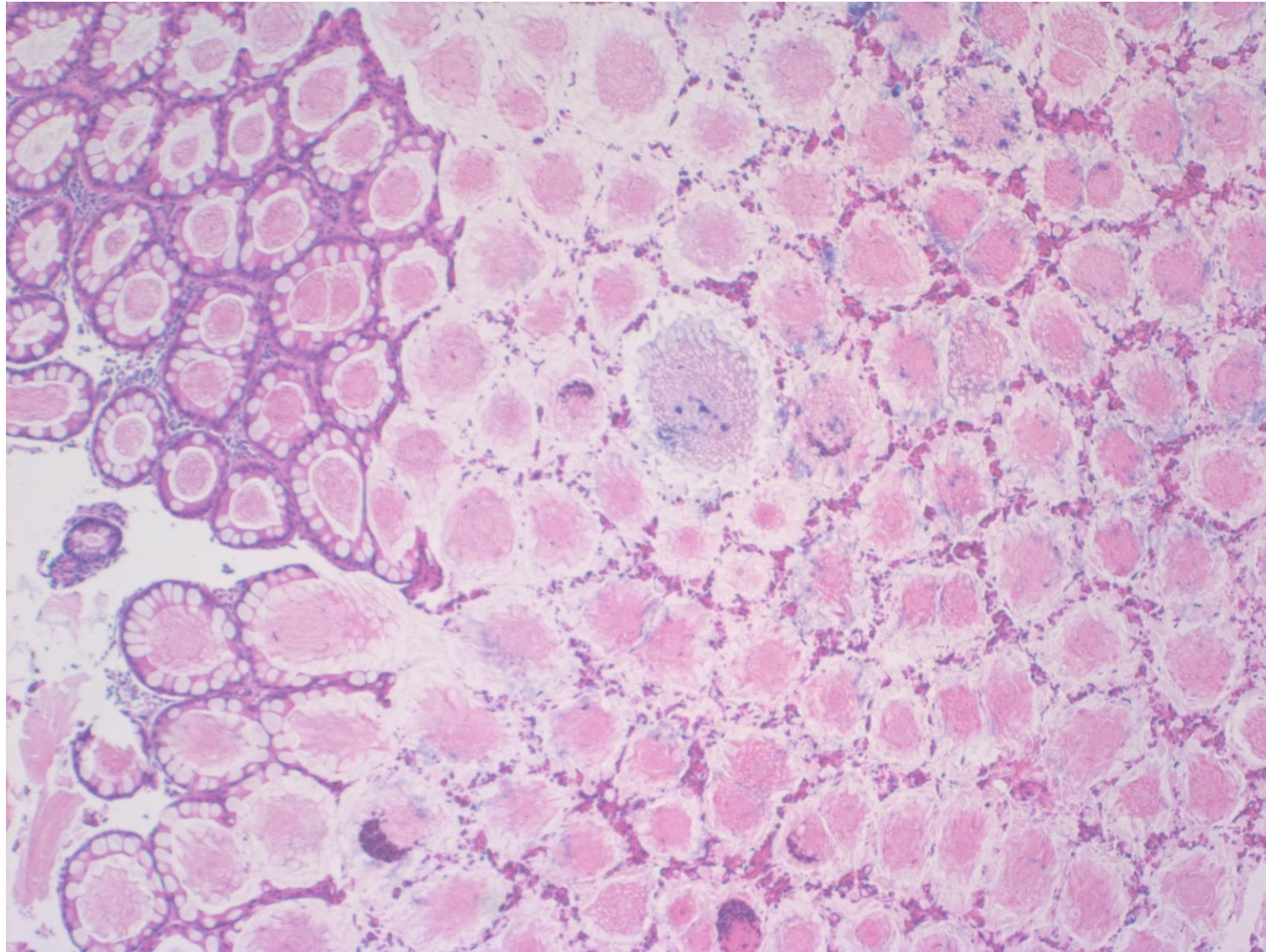
Occult blood test necessitated colonofiberscopic study for a 67-year-old lady. In addition to a metaplastic polyp and a few tubular adenomas, a 7 mm-sized flat elevation is endoscopically seen in the cecum.



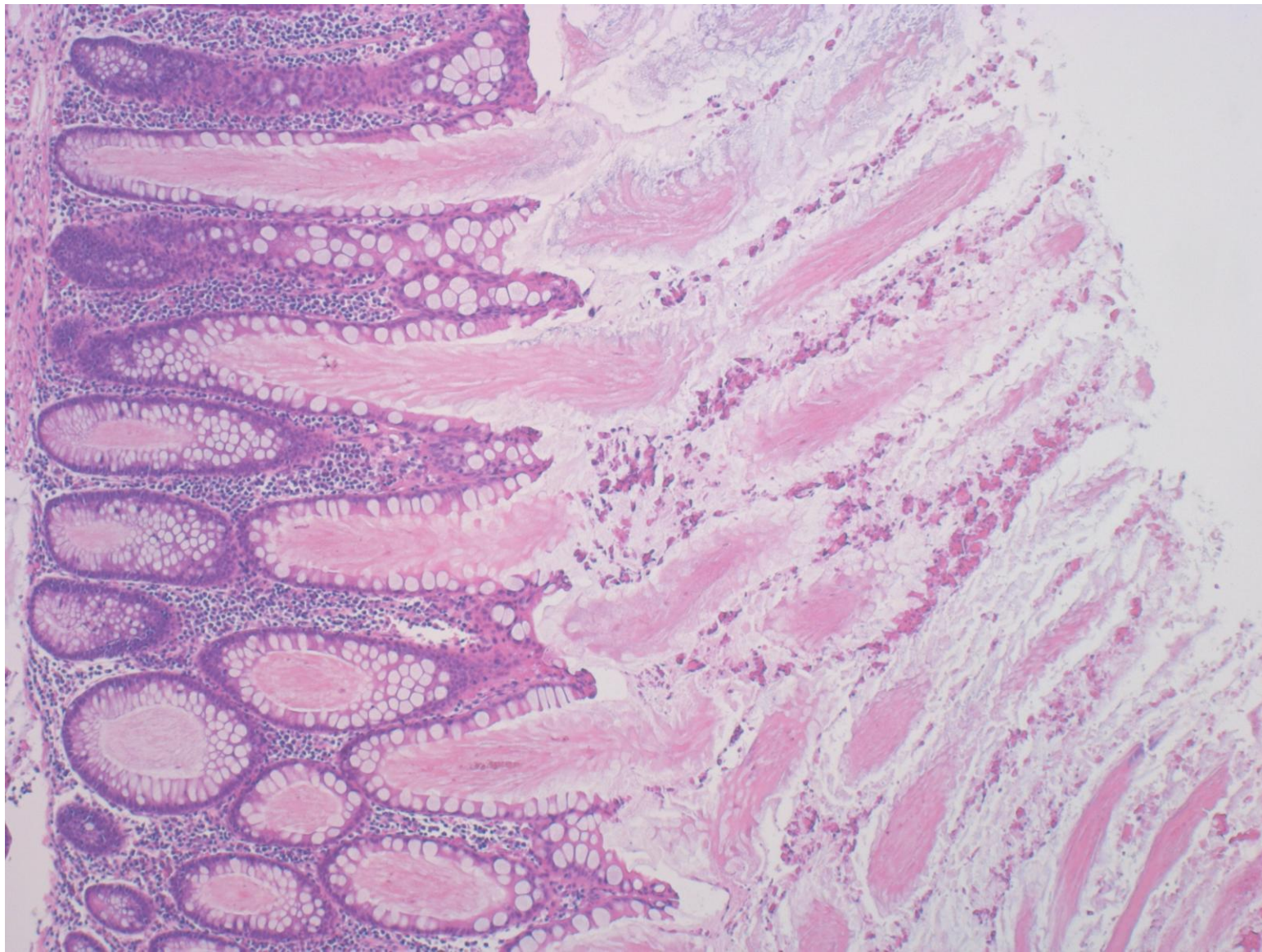
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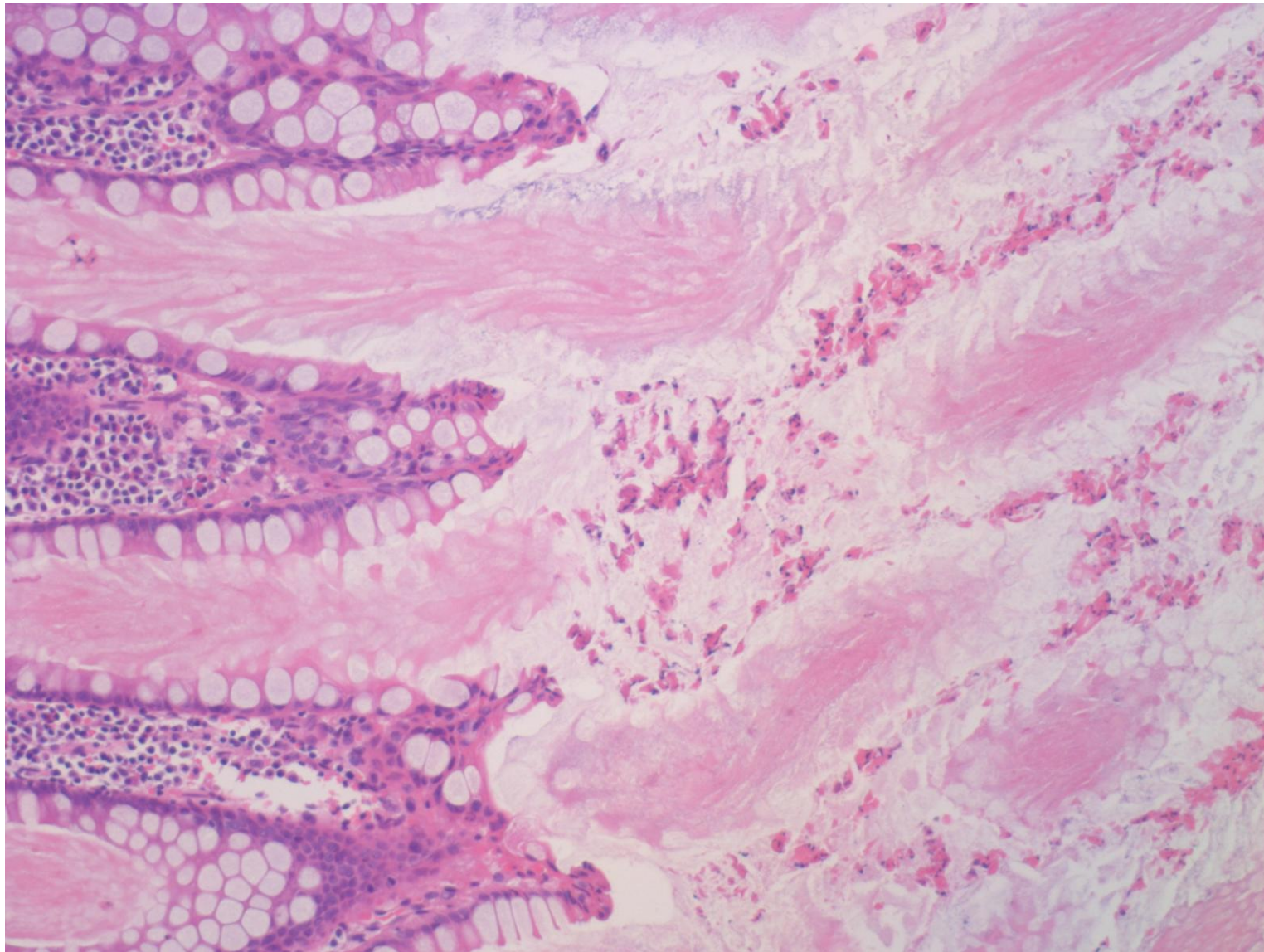
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Eosinophilic secretory rodlets secreted from the colonic crypts are layered on the mucosal surface. Note the microscopic resemblance to the koilin membrane of the gizzard of the bird. H&E-1



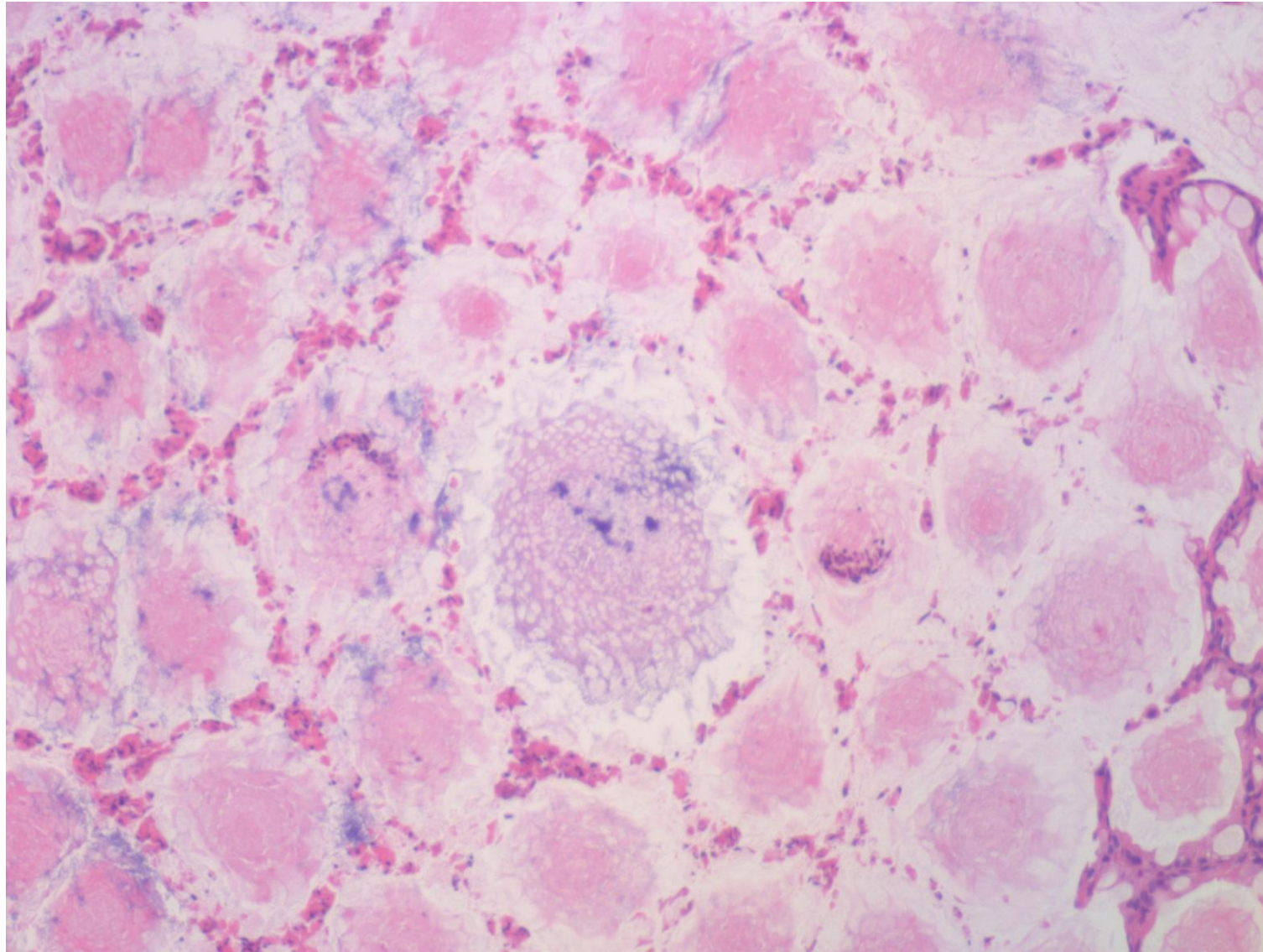
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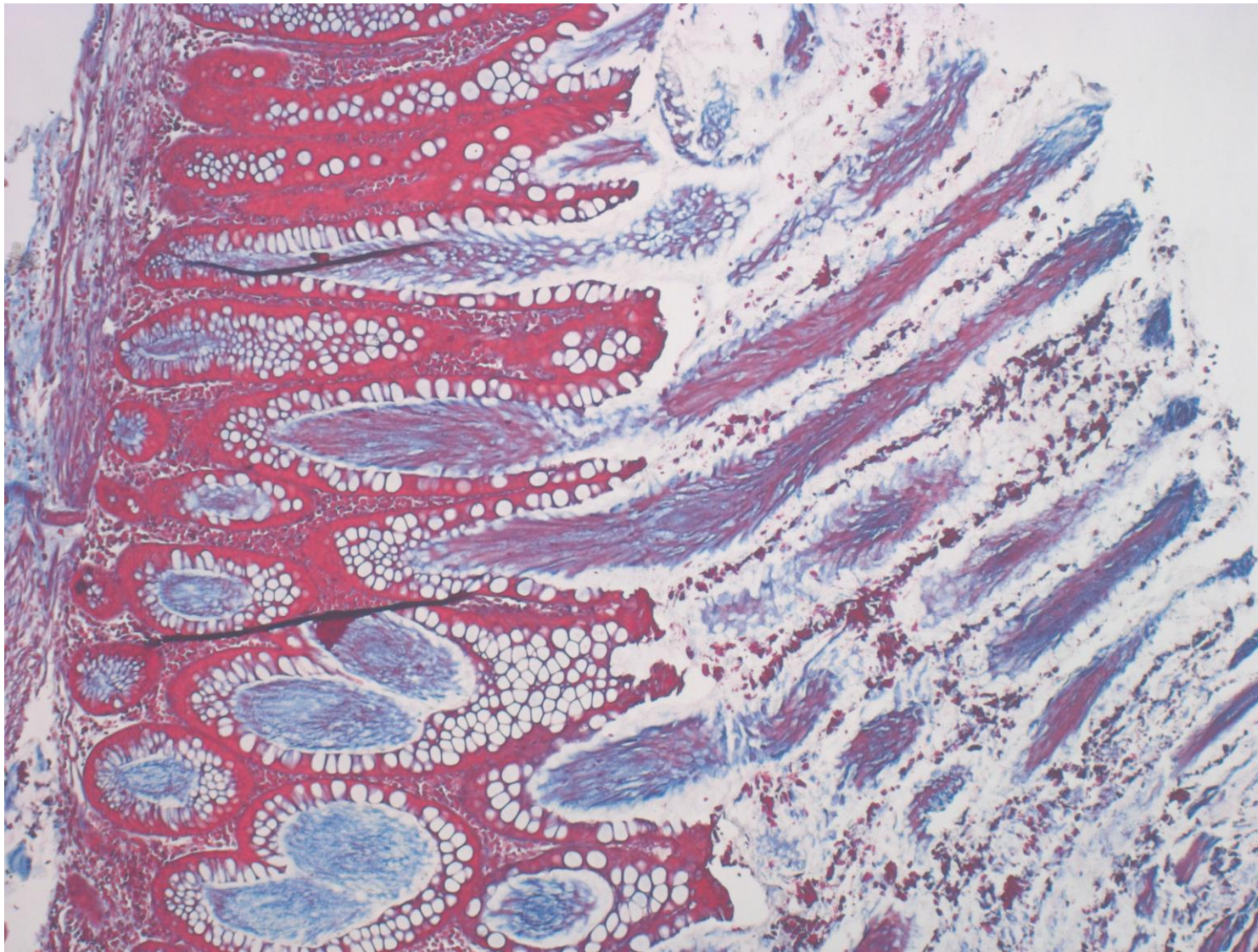
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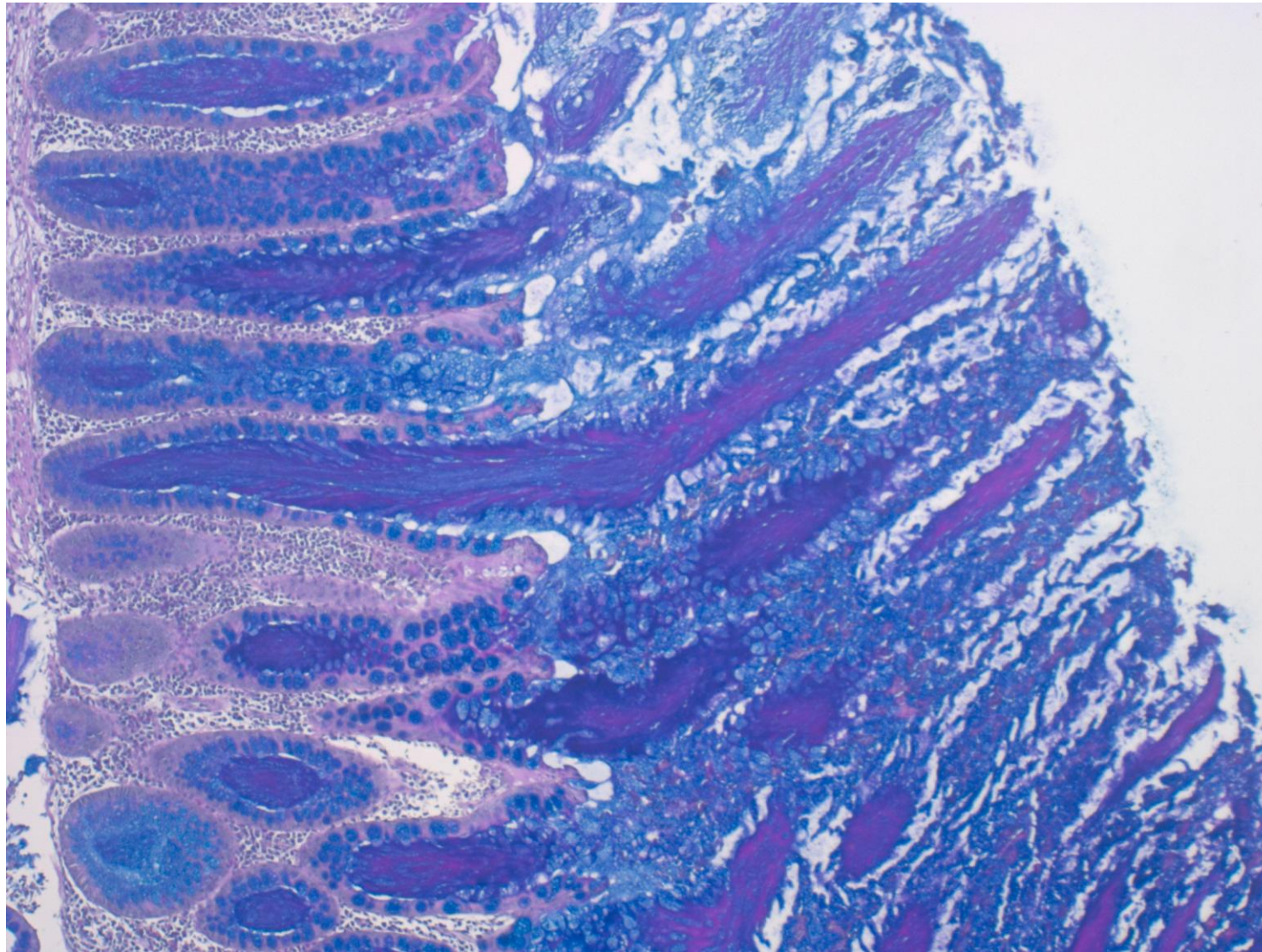
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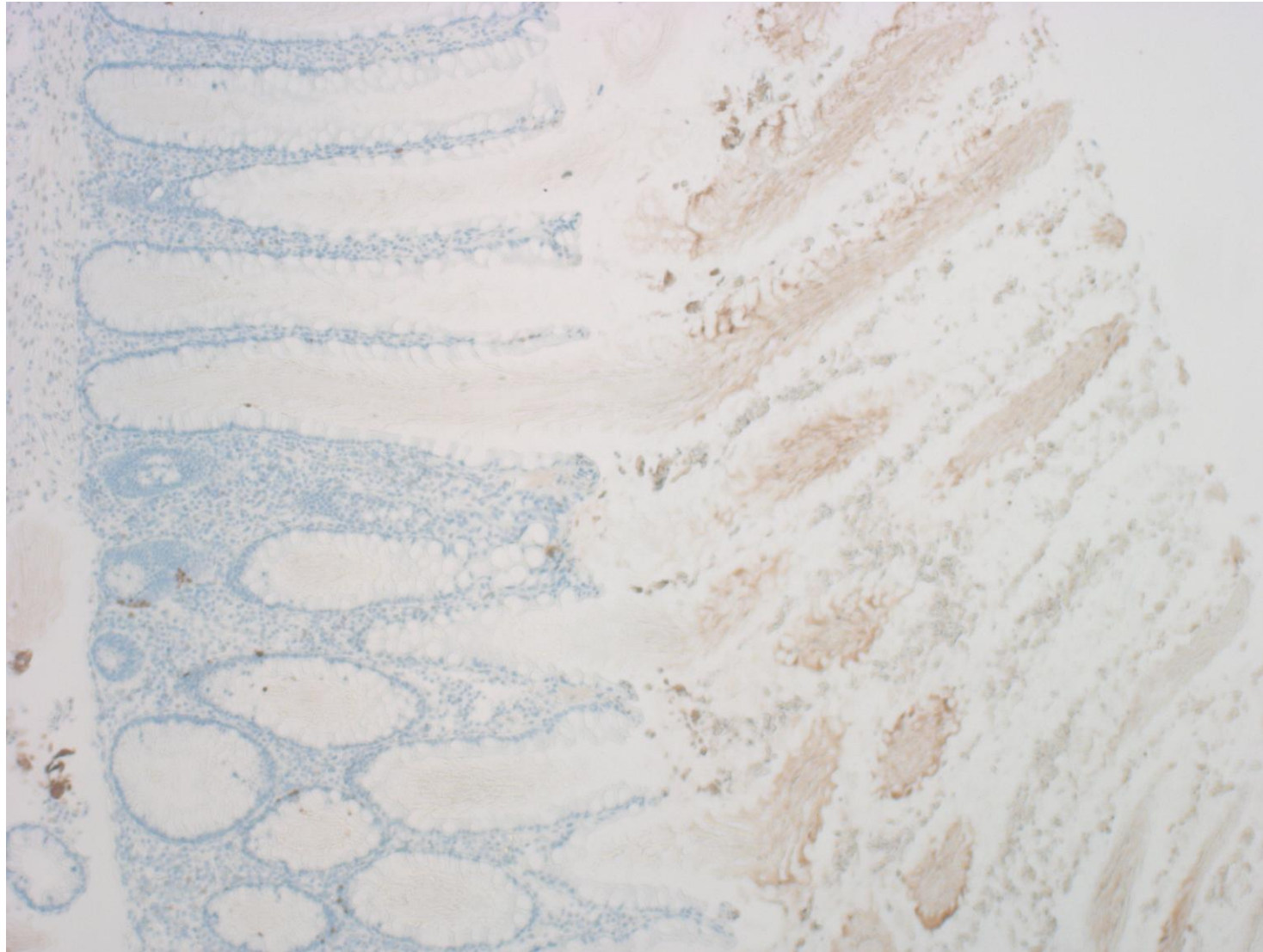
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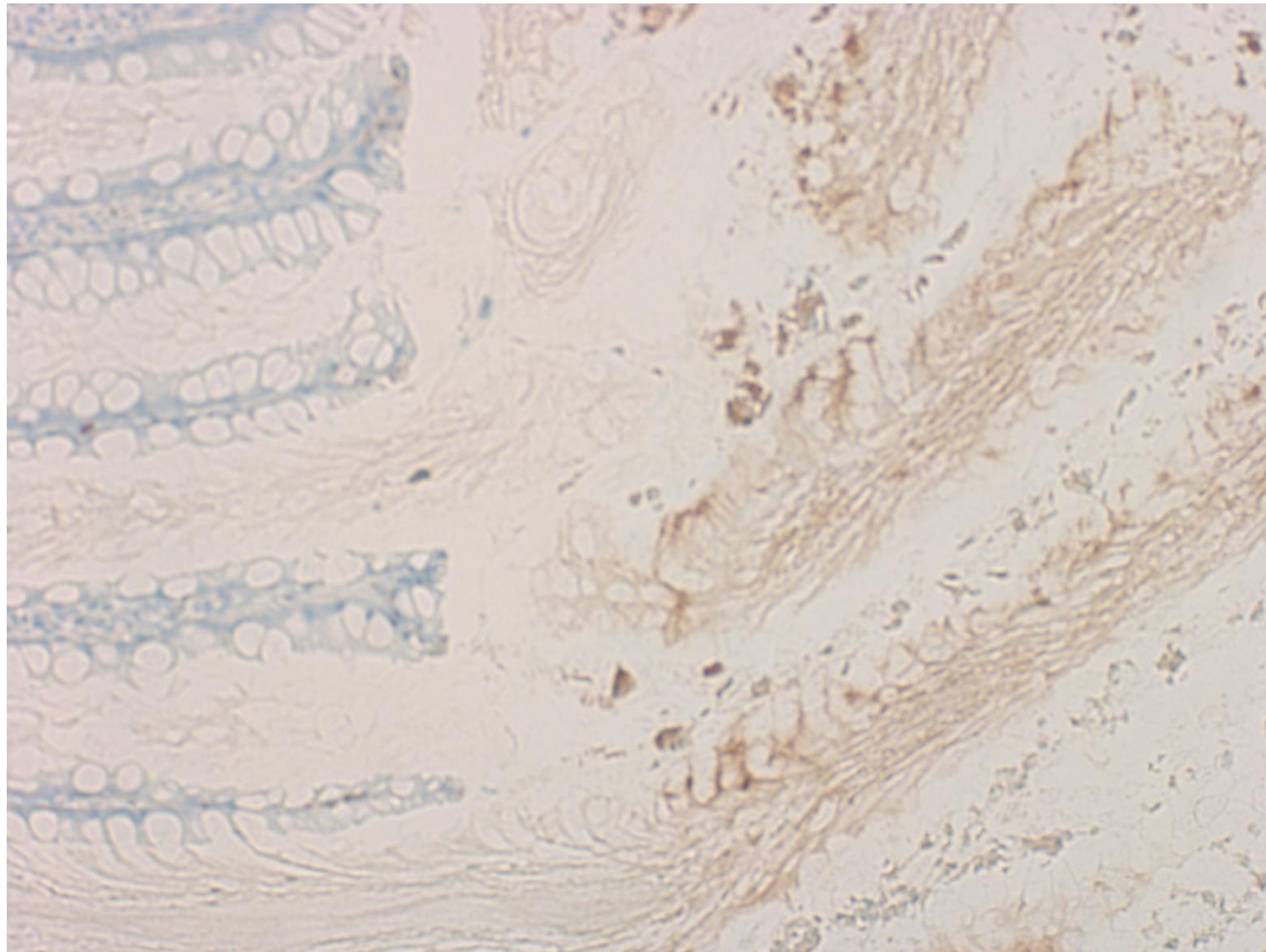
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. Blue staining by Masson trichrome staining may suggest the formation of mechanically tolerant, fibrillar membrane structures. Masson trichrome



Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. Alcian blue-PAS staining show the rodlets are composed of a mixture of red (PAS-reactive) and blue (AB-positive) mucinous material. AB-PAS



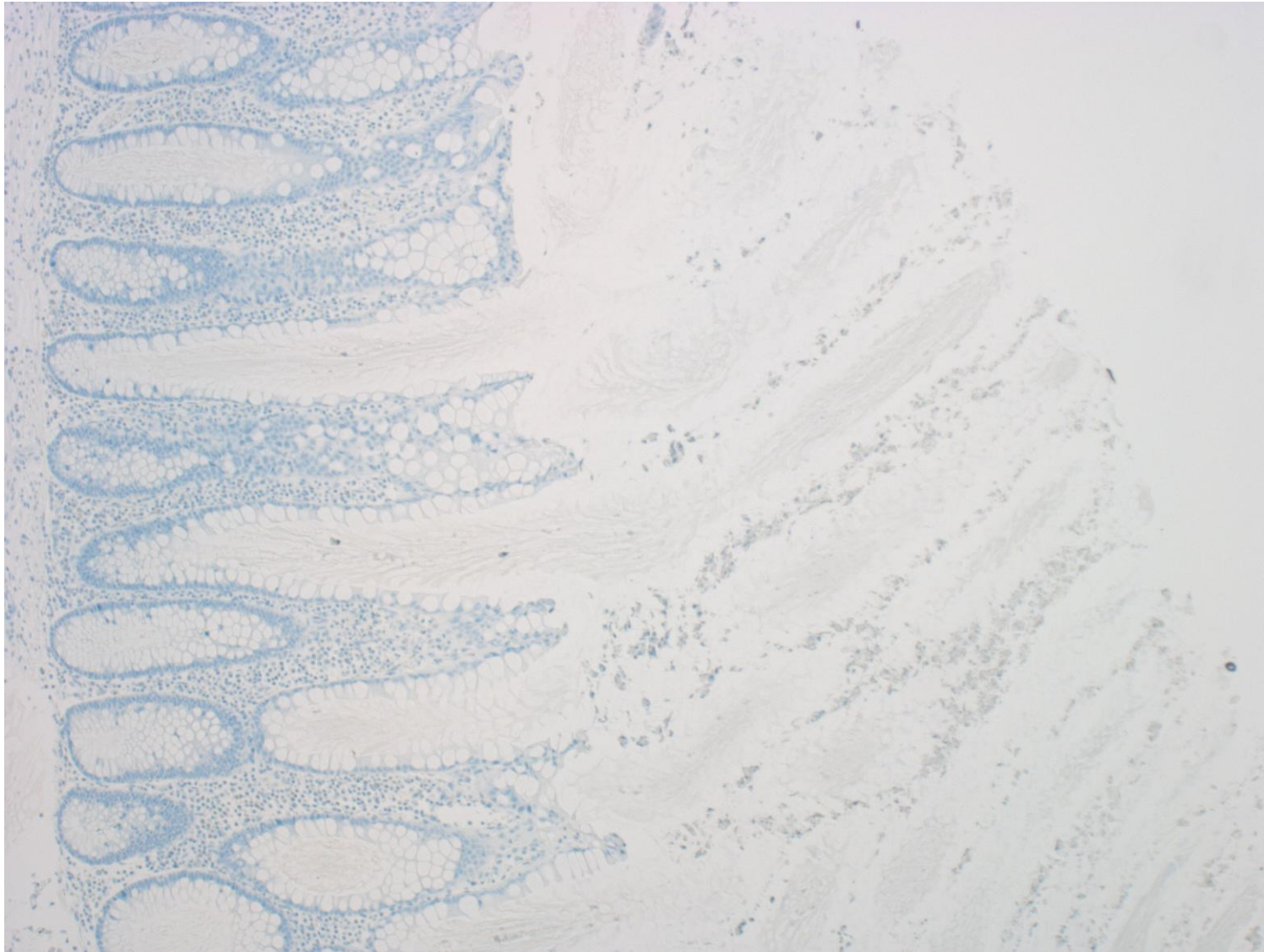
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. Apoptotic nuclei with cleaved caspase-3 immunoreactivity are observed at the periphery of the rodlets. Immunostaining for cleaved caspase-3



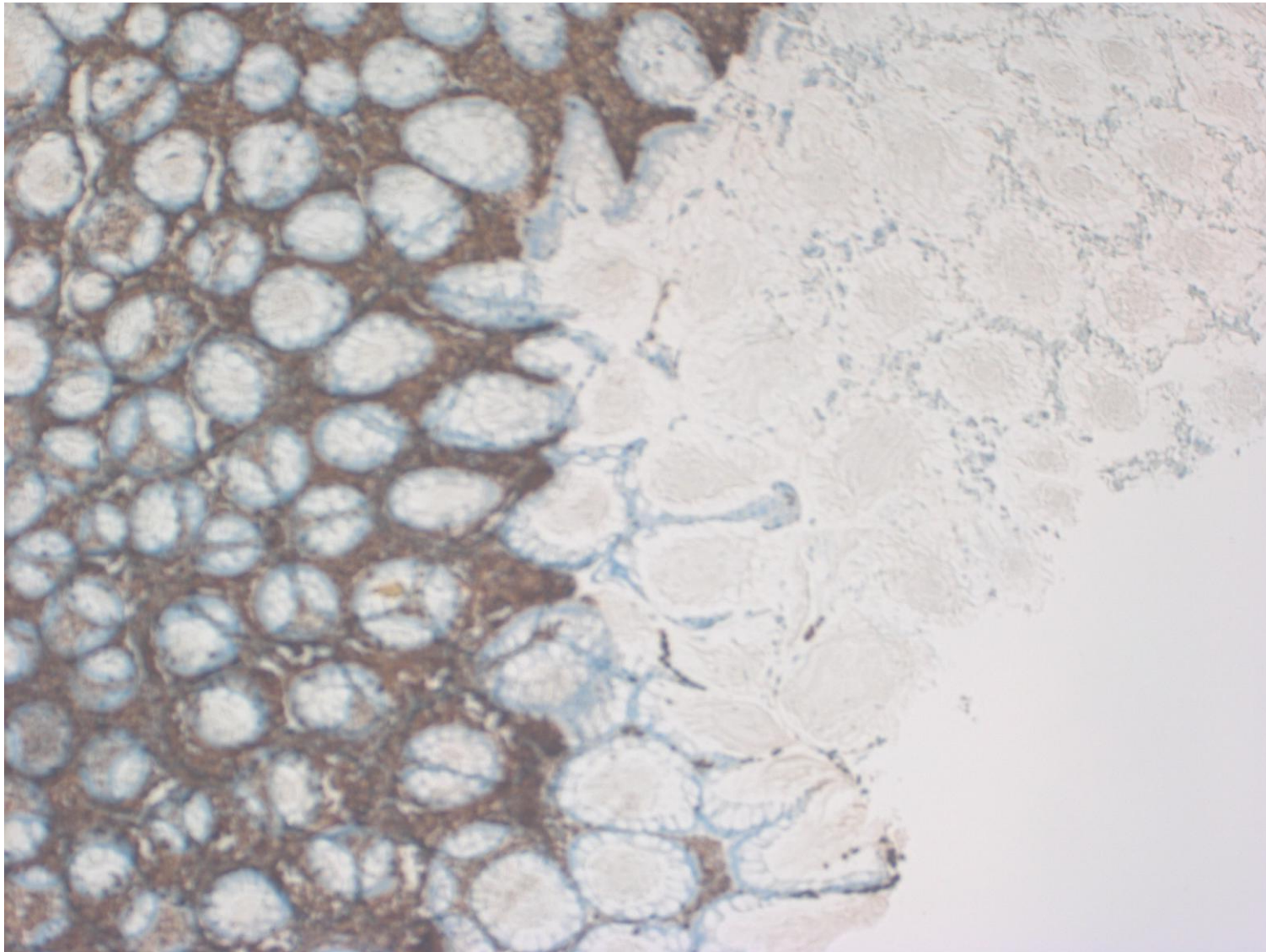
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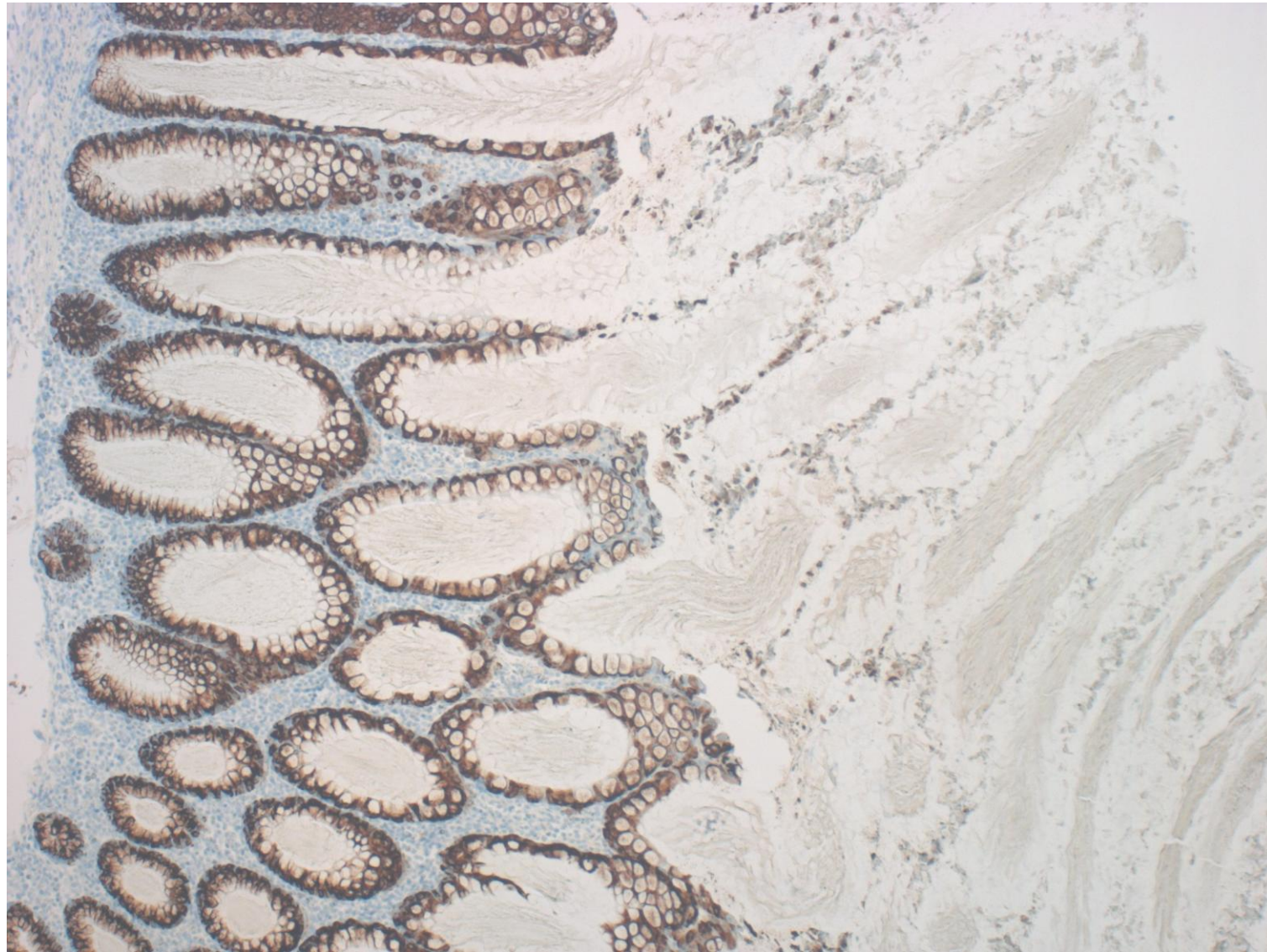
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. CK20 immunoreactivity is observed mainly at the periphery of the rodlets, indicating that the rodlets are composed of apoptotic crypt epithelial cells with shelled/empty nuclei. Immunostaining for CK20



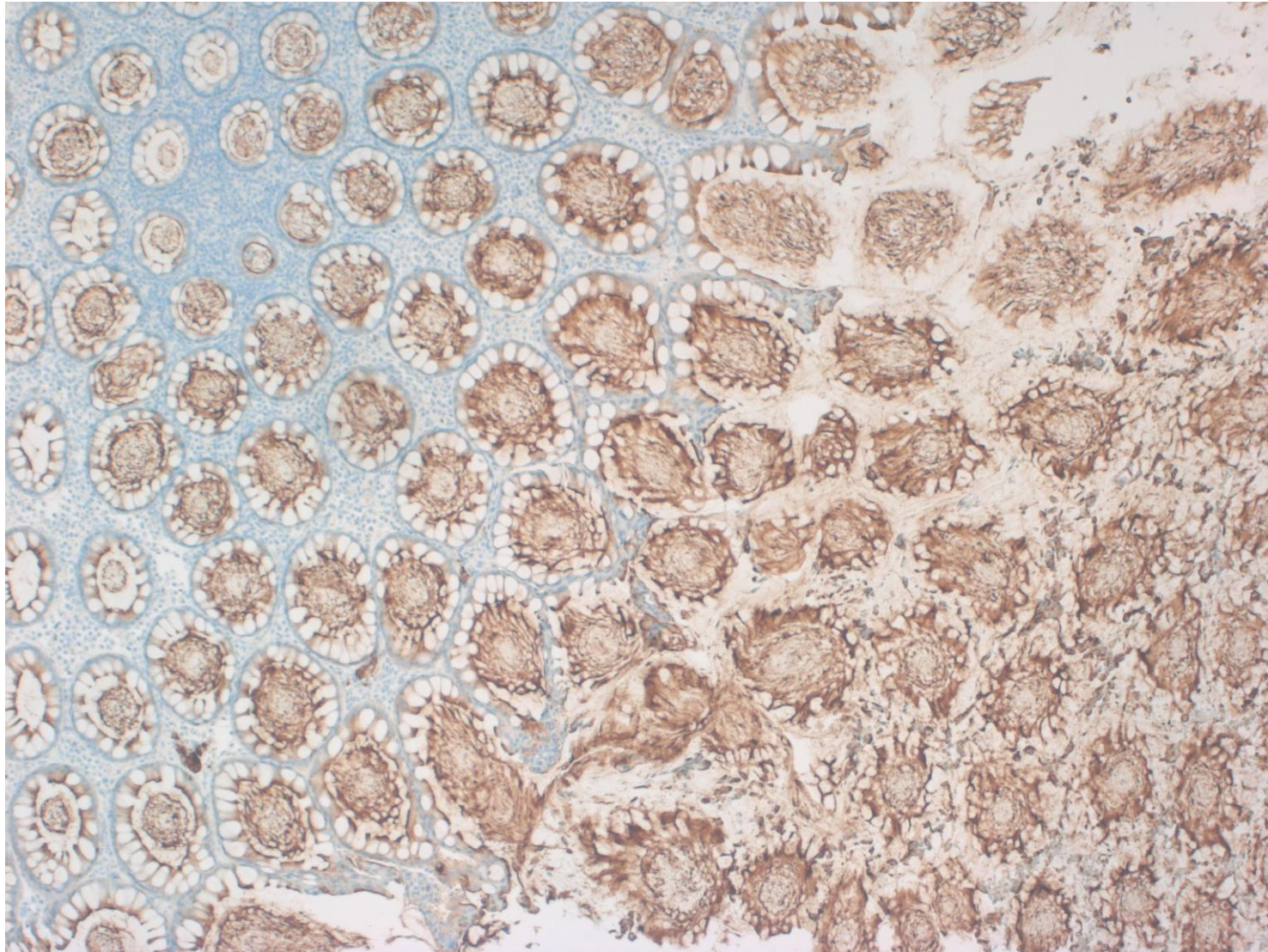
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. CK7 immunoreactivity is negative in both the crypts and rodlets. Immunostaining for CK7



Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. vimentin immunoreactivity is seen only in the lamina propria mucosae. The crypts and rodlets are negative for vimentin. Immunostaining for vimentin

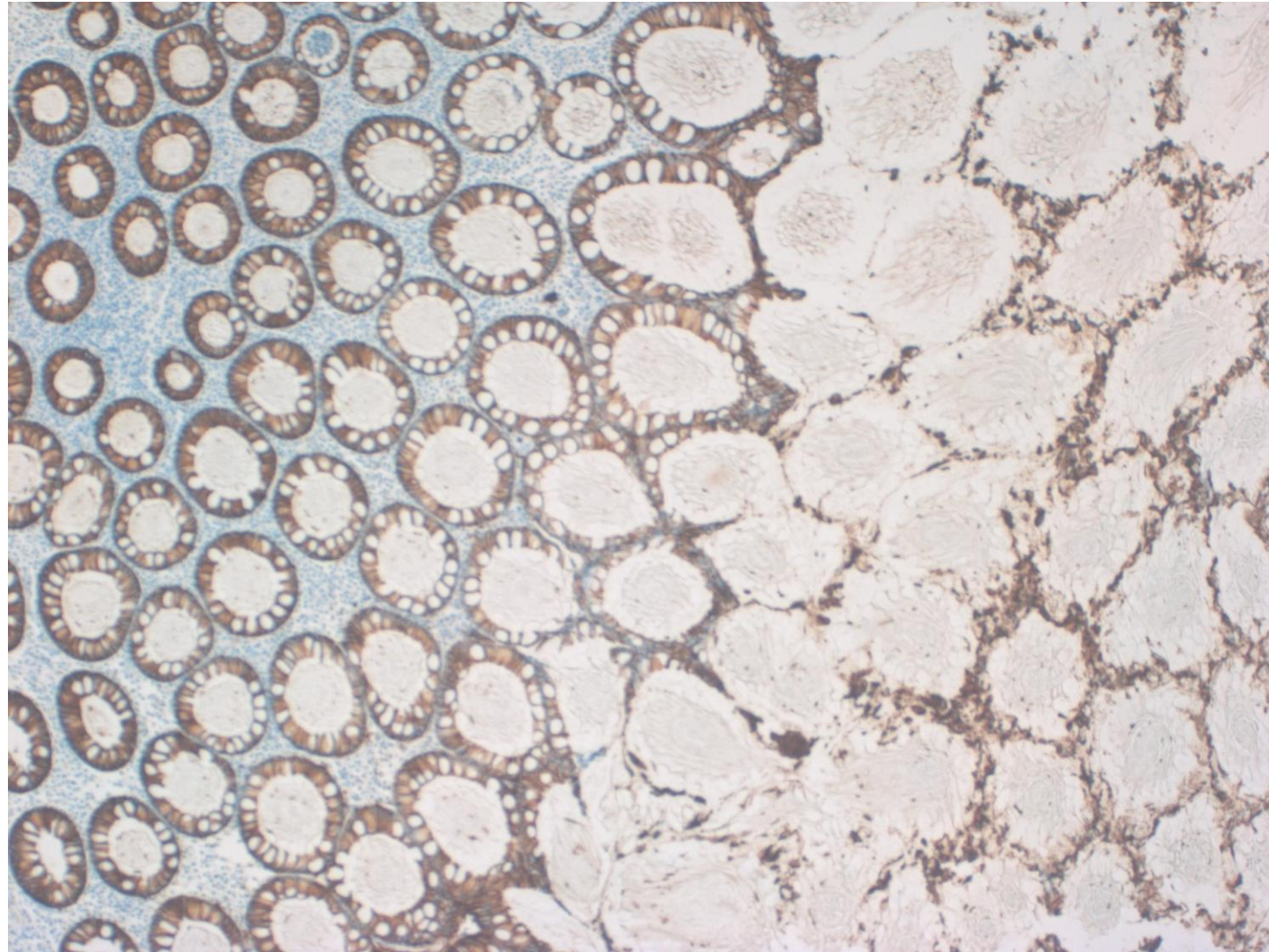


Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. MUC2 immunoreactivity, strongly positive in the crypt epithelial cells, is observed in the cytoplasm of apoptotic crypt epithelial cells distributed at the periphery of the rodlets. Immunostaining for MUC2

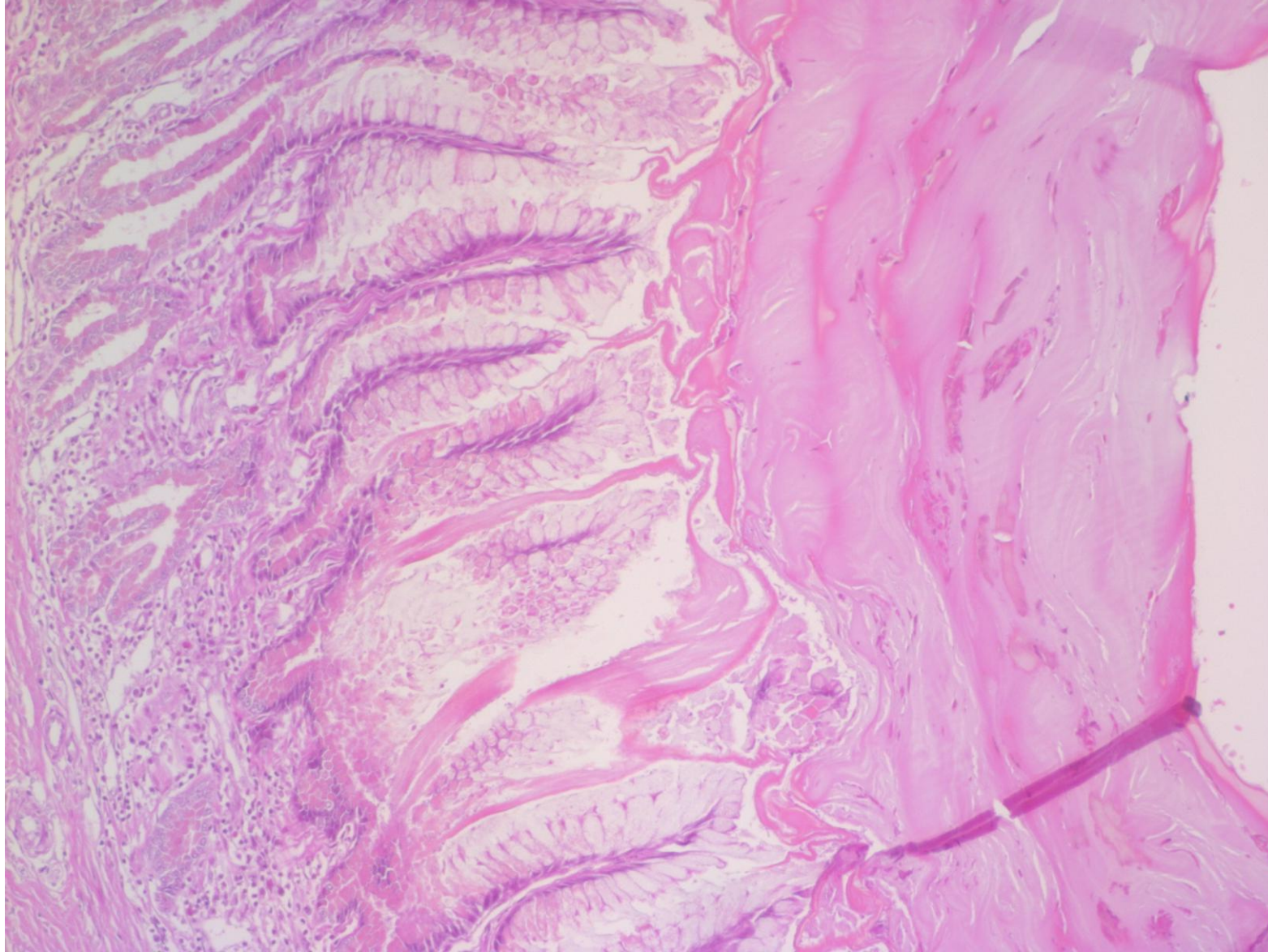


Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. CEA immunoreactivity is observed in the cytoplasm of both viable crypt epithelial cells and apoptotic crypt epithelial cells in the rodlets. Immunostaining for CEA using a monoclonal antibody

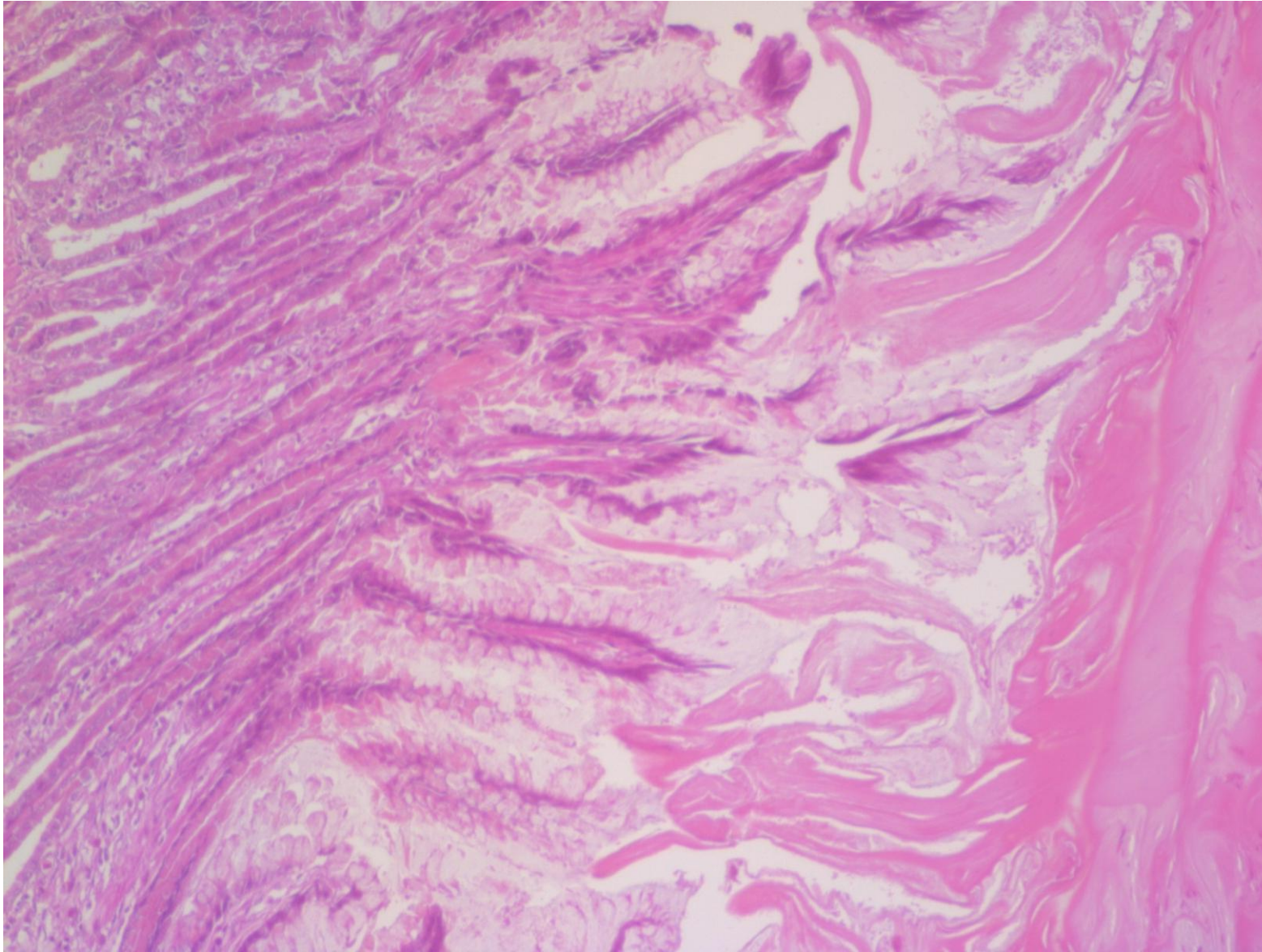
BerEP4



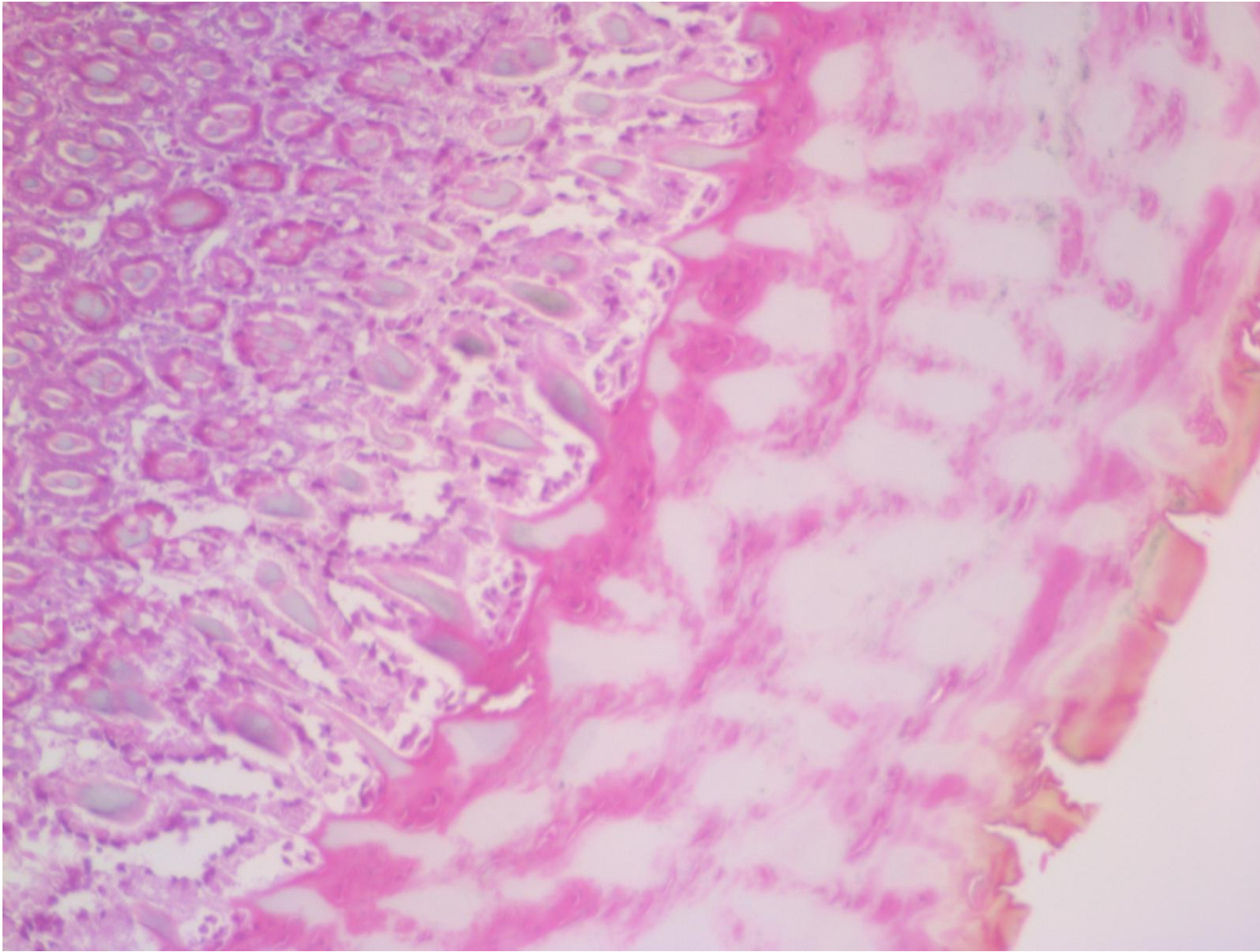
Koilin-like metaplasia seen in the cecum of a 67-year-old lady. Rodlets secreted from the colonic crypts are layered on the mucosal surface. BER-EP4 immunoreactivity is observed in the cytoplasm of both viable crypt epithelial cells and apoptotic crypt epithelial cells in the rodlets. Immunostaining for BER-EP4



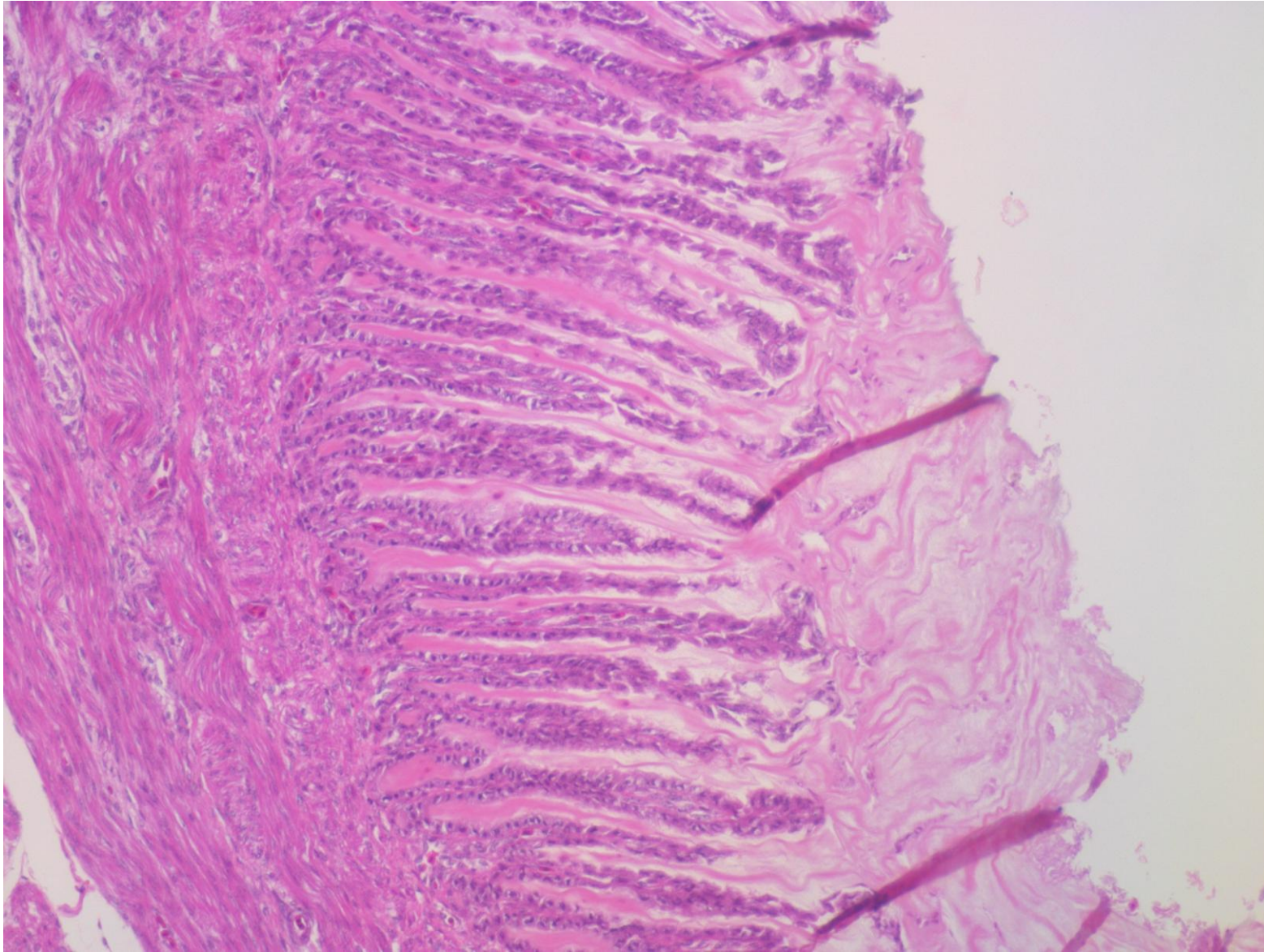
Koilin membrane covering the gizzard of the **stork**. A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



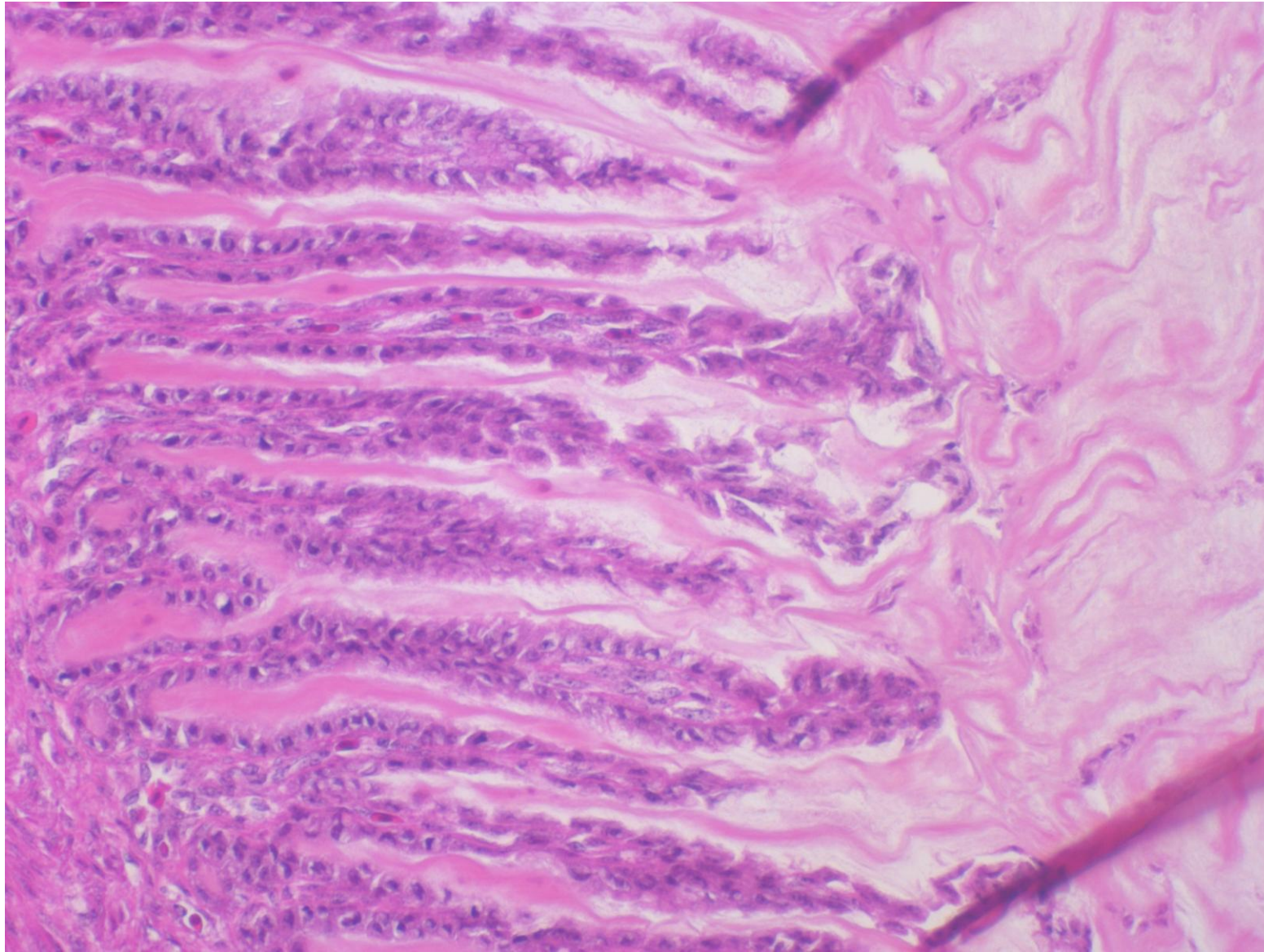
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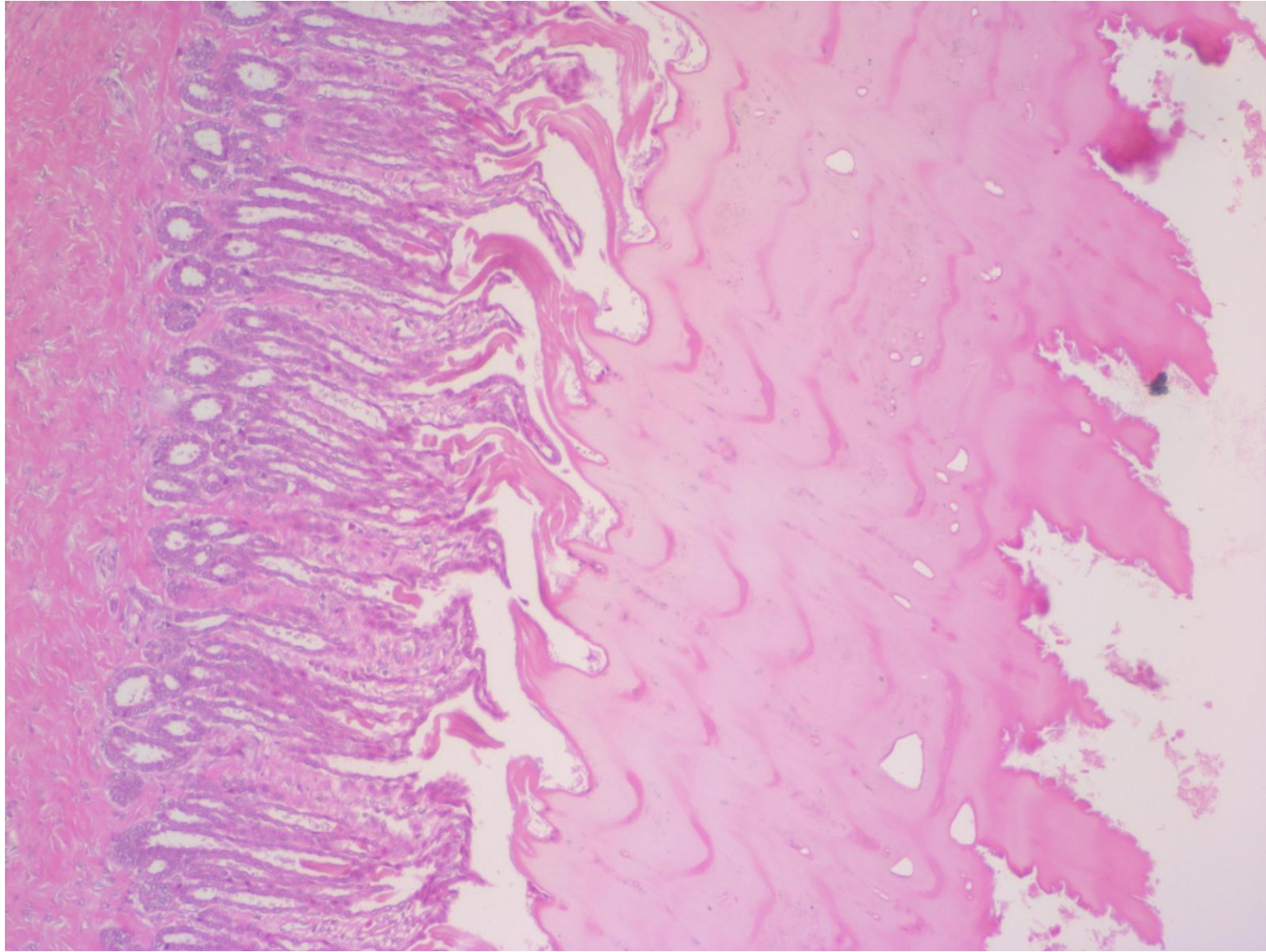
Koilin membrane covering the gizzard of the common **crane** (*Grus grus lilfordi*). A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



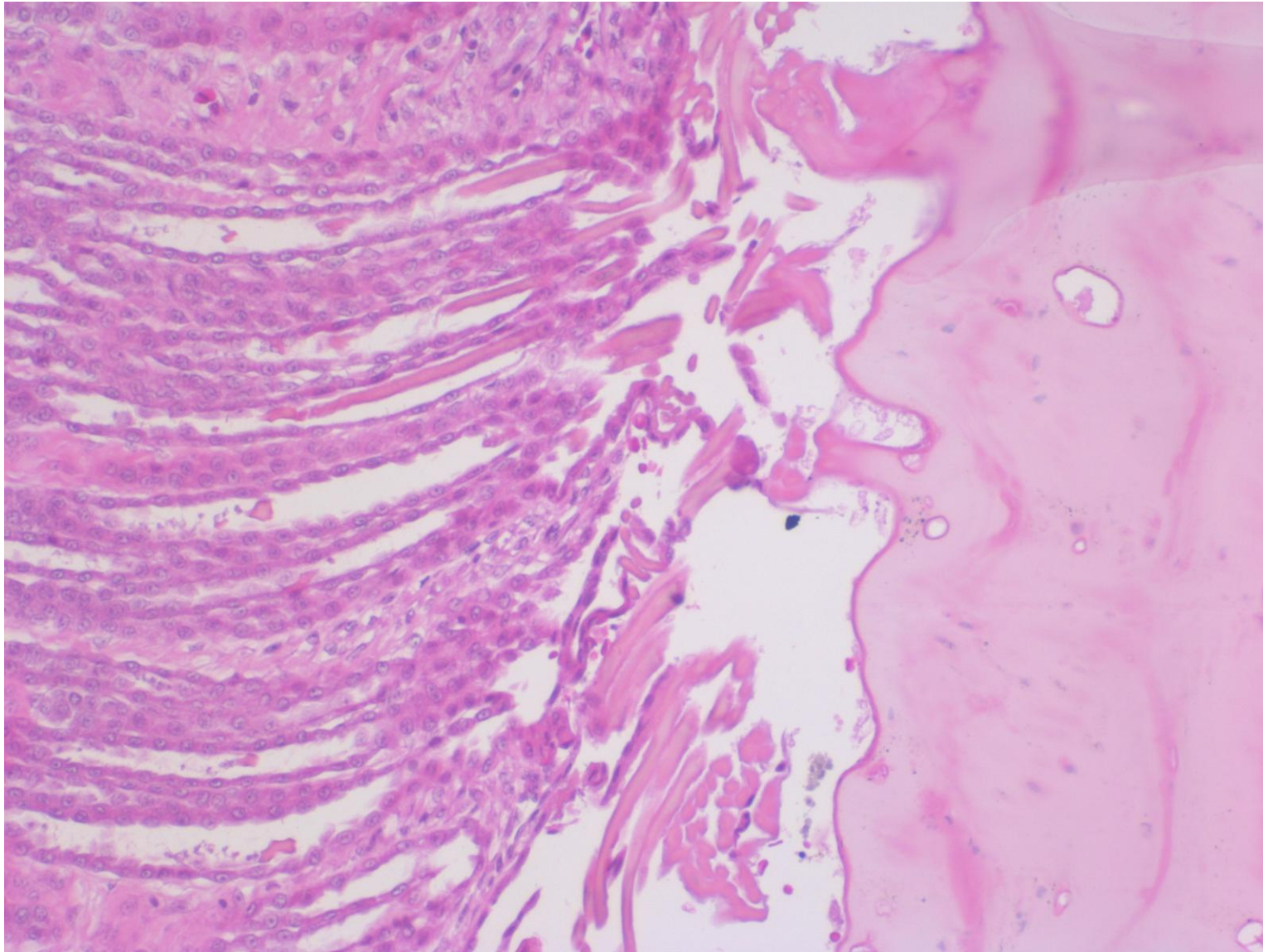
Koilin membrane covering the gizzard of the **emu** (*Dromaius novaehollandiae*), a large flightless bird in Australia. A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



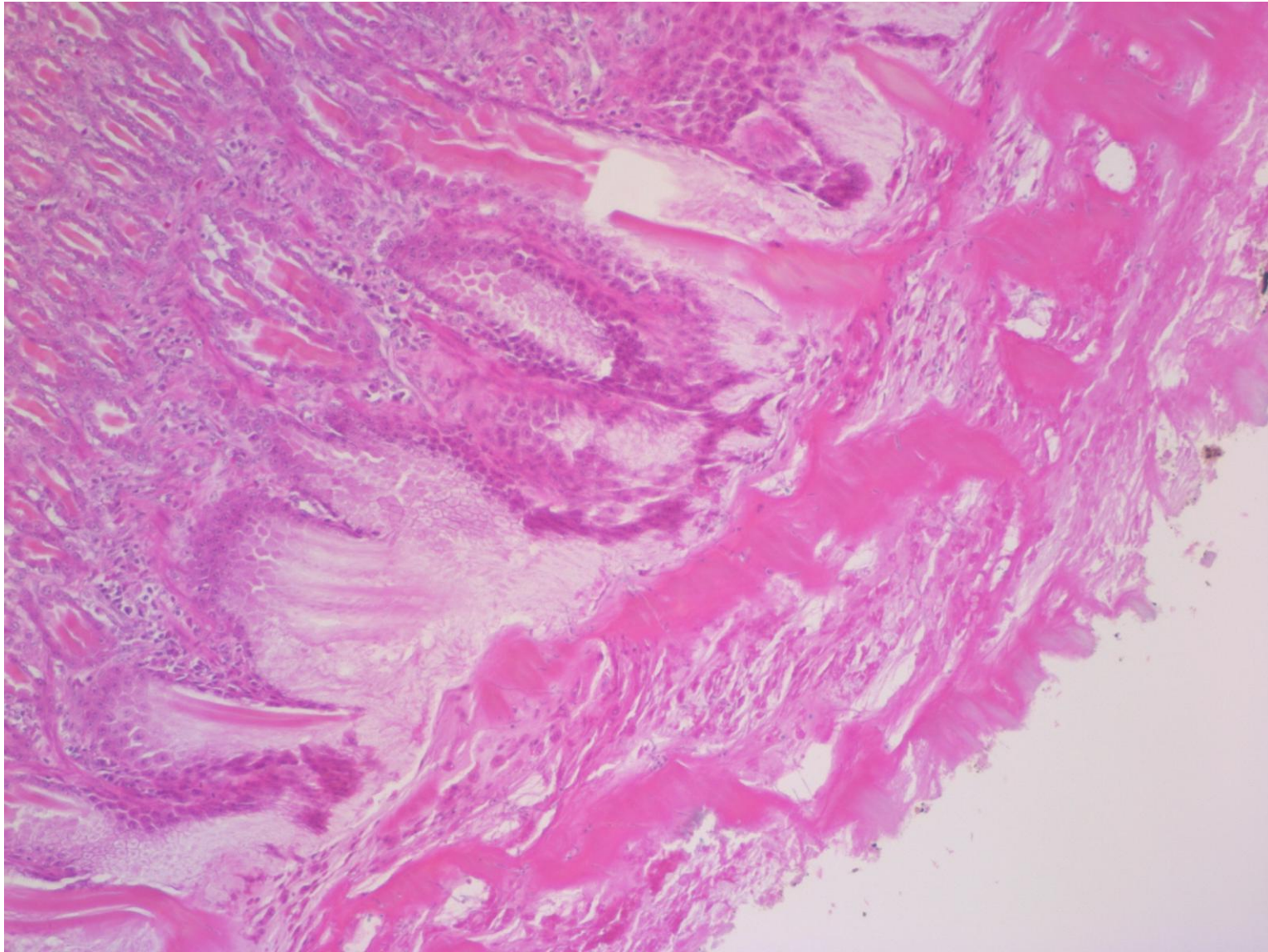
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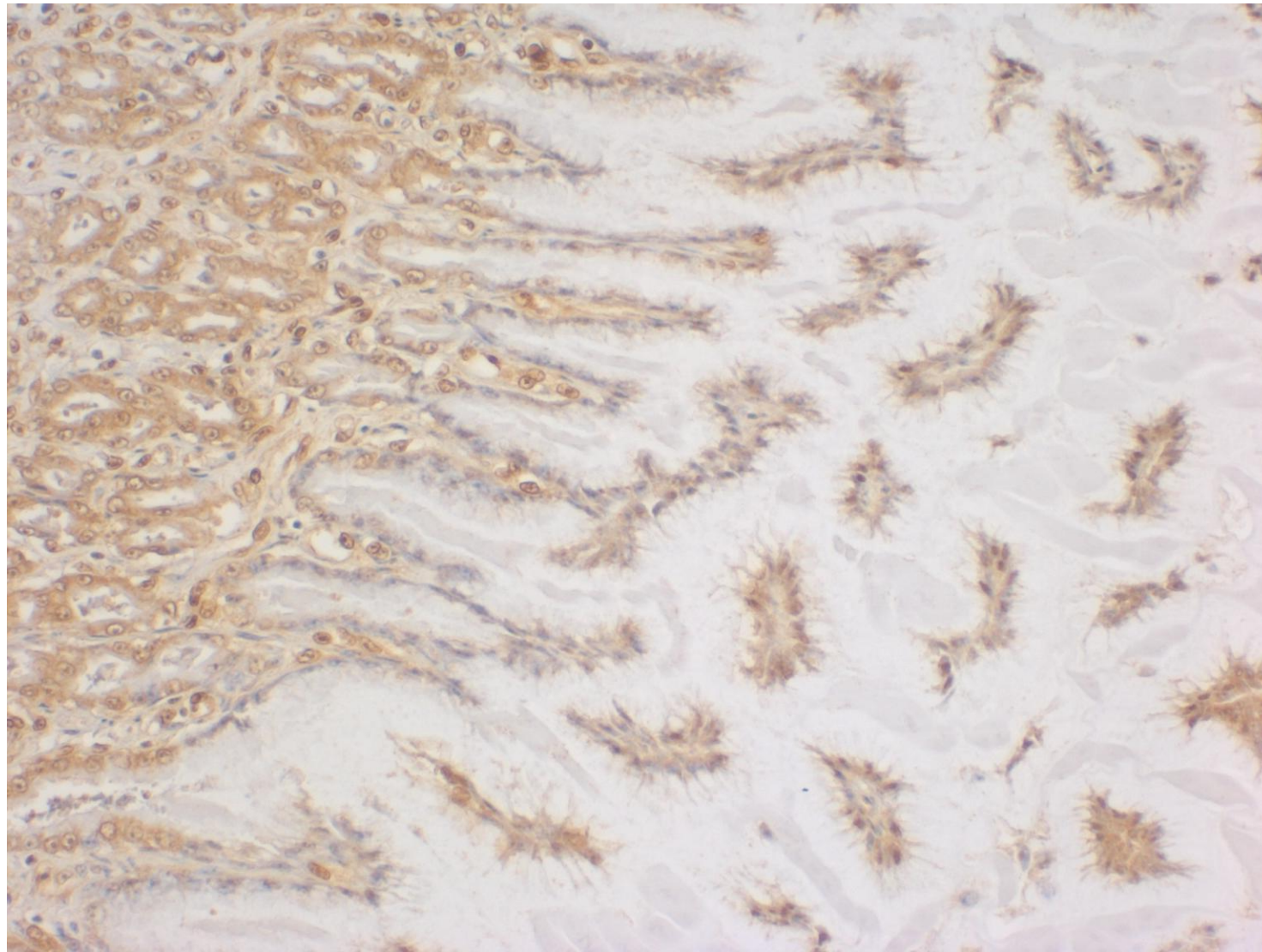
Koilin membrane covering the gizzard of ***Rheinardia ocellata*** (Kanmuri-seiran in Japanese), a kind of pheasant, living in the high-altitude forest in Asia. A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



Koilin membrane covering the gizzard of ***Rheinardia ocellata*** (Kanmuri-seiran in Japanese), a kind of pheasant, living in the high-altitude forest in Asia. A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



Koilin membrane covering the gizzard of ***Cereopsis novaehollandiae***, a kind of land duck living in Southern Australia. A thick eosinophilic cuticle is composed of secretory substances (rodlets) secreted from the glandular layer. H&E



Koilin membrane covering the gizzard of ***Cereopsis novaehollandiae***, a kind of land duck living in Southern Australia. A thick eosinophilic cuticle is composed of secretory substances (rodlets) composed of apoptotic glandular epithelial cells. Immunostaining for single-stranded DNA, a marker of apoptosis.