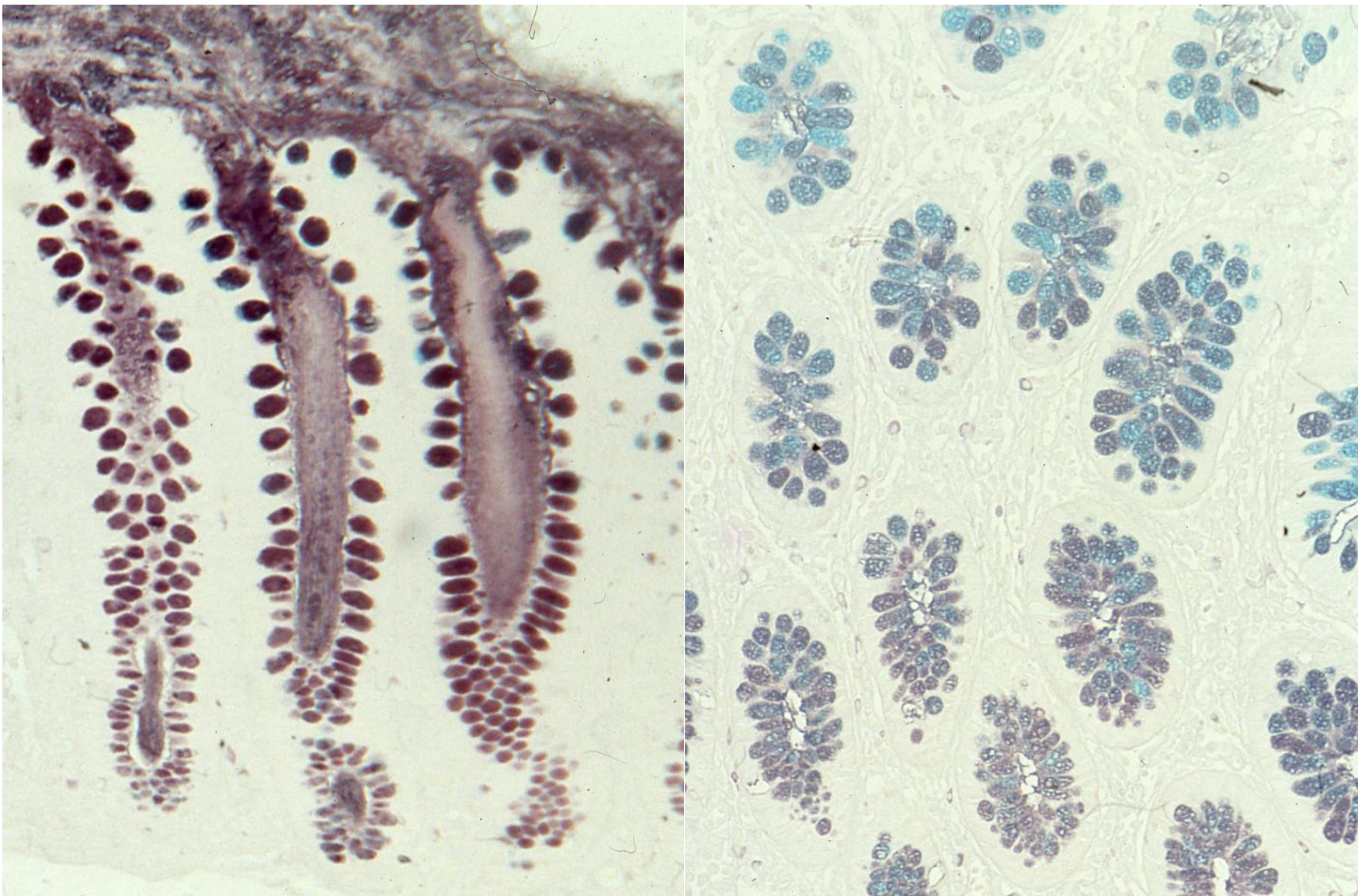


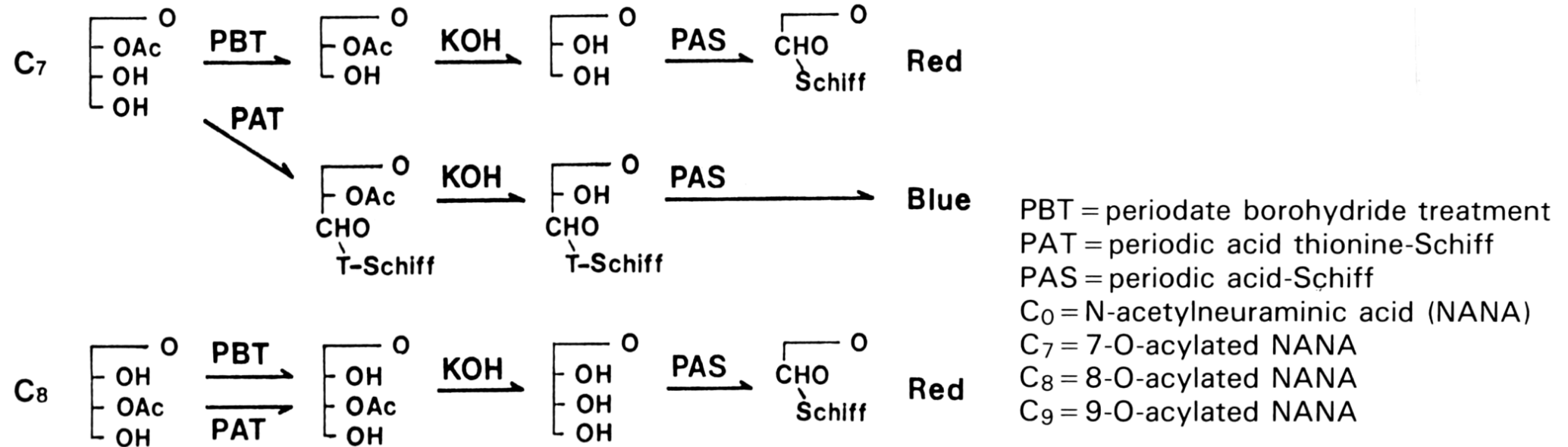
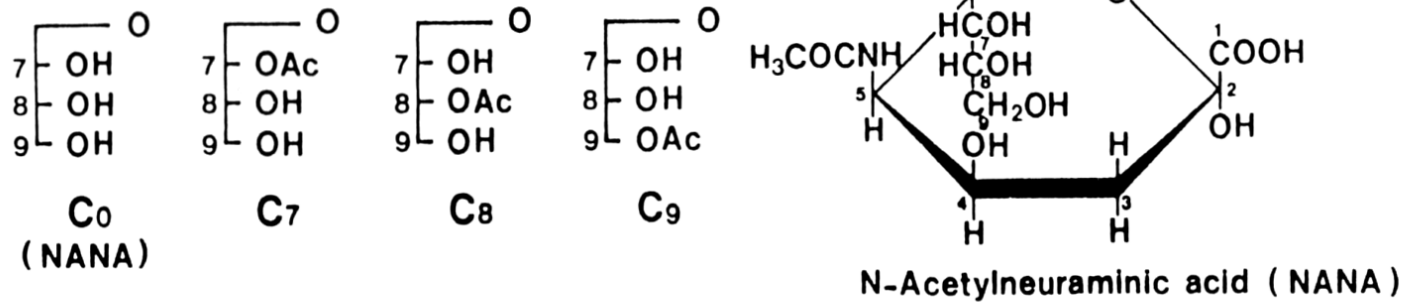
Goblet cell mucin types in the normal colonic mucosa

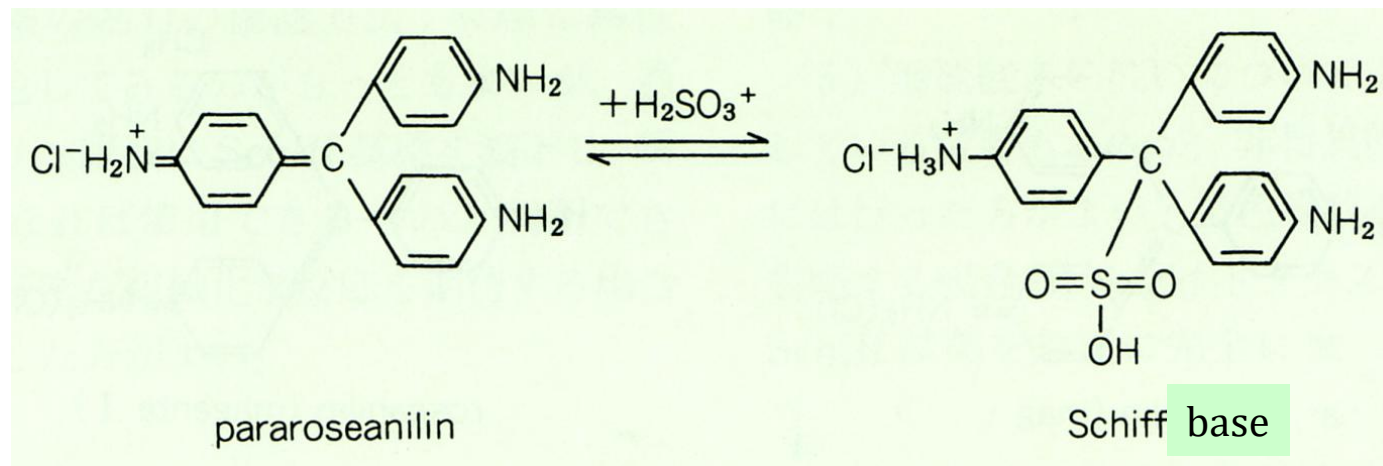
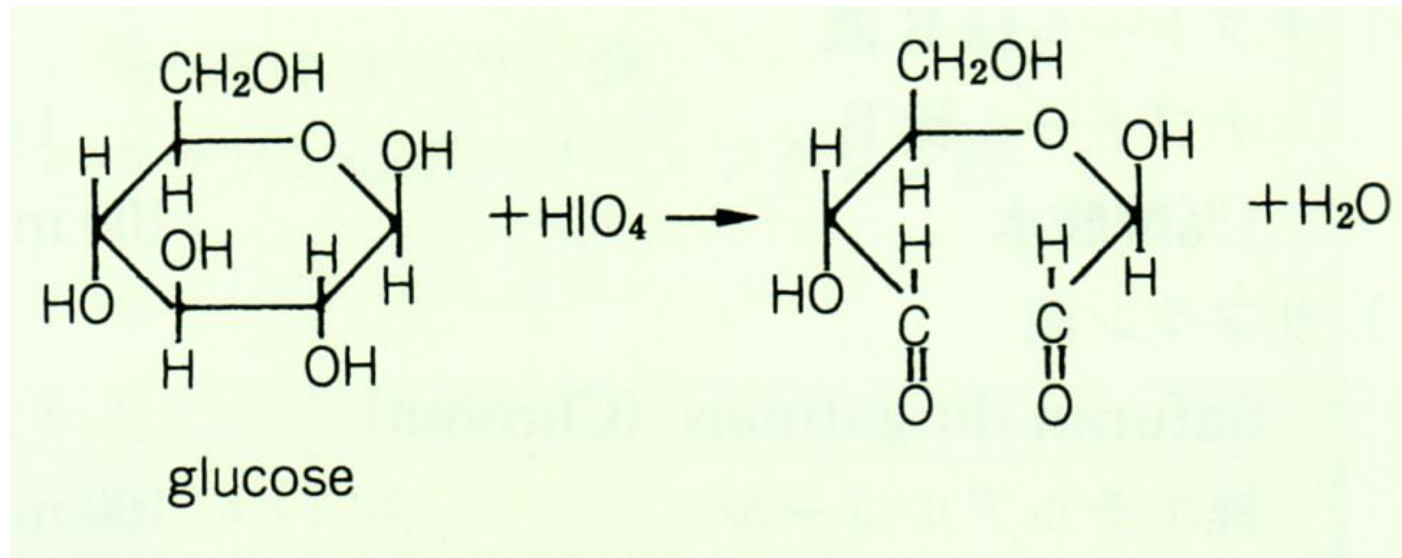
The presence of O-acetylated sialic acid is unique in colonic goblet cell mucin. In addition to periodic acid-Schiff (PAS) reaction, alkaline hydrolysis-induced PAS reactions and mild oxidation-Schiff reaction have been applied. Goblet cells in the normal colonic mucosa can histochemically be divided into two major mucin (sialic acid) types. In one dominant type, the reactivity for 8-O-acetylated sialic acid is identified, while the other type expresses both 7-O-acetylated sialic acid and non-O-acetylated sialic acid (N-acetyl neuraminic acid: NANA). 8-O-acetylated type occasionally accompanies NANA expression. Neoplastic goblet cells reveal reduced expression of O-acetylated sialic acid.

Ref.: Tsutsumi Y. "Mucin types" in normal and neoplastic colonic goblet cells: a mucin histochemical study. Tokai J Exp Clin Med 1990; 15(4): 335-346. PMID: 1718060



High iron diamine-Alcian blue (HID-AB) staining for normal colonic mucin. Black-stained sulfomucin is predominant in goblet cells. In some cases, blue-stained sialomucin-containing goblet cells are intermingled. HID-AB staining can distinguish sulfomucin from sialomucin in the same section.

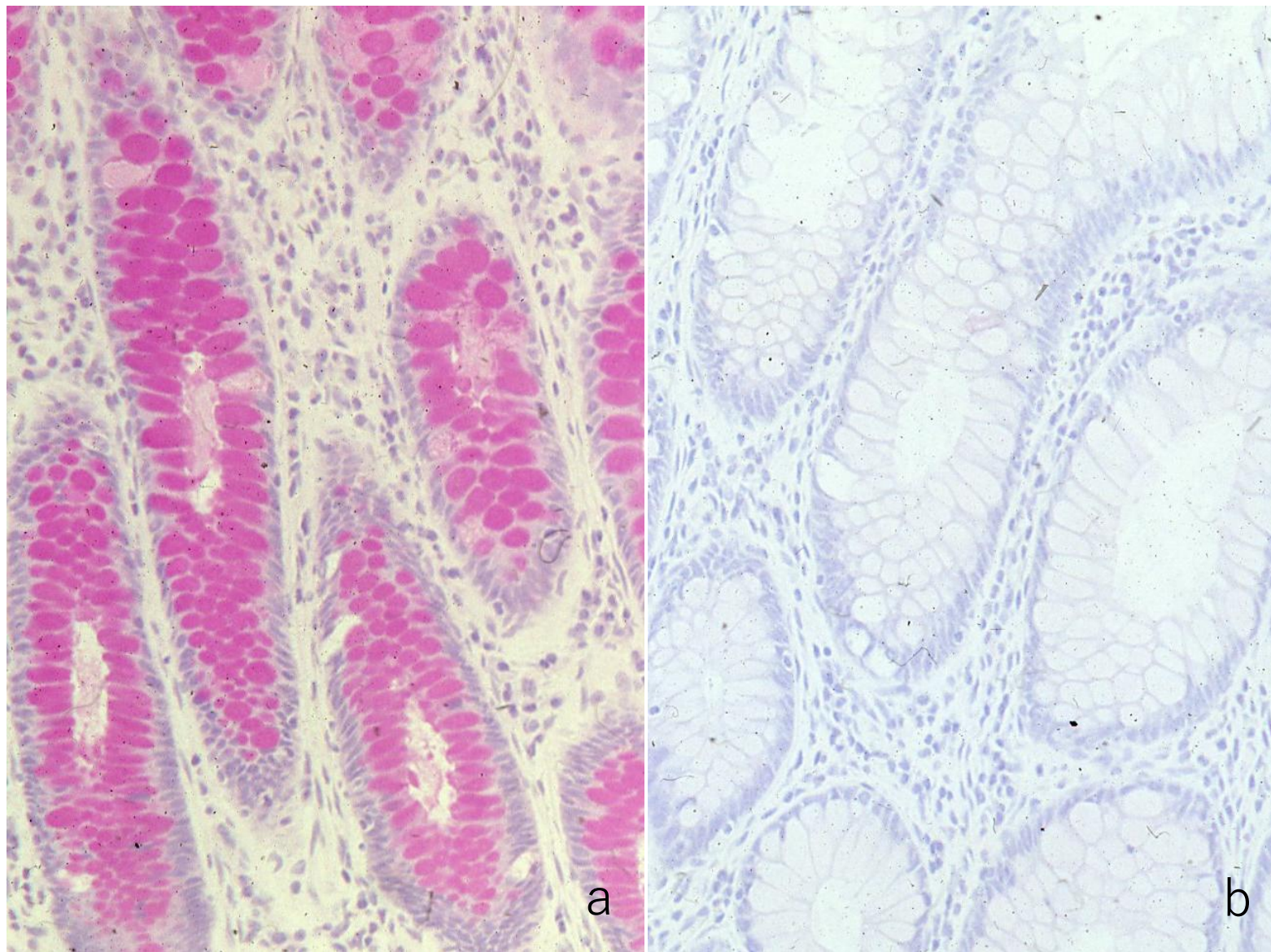




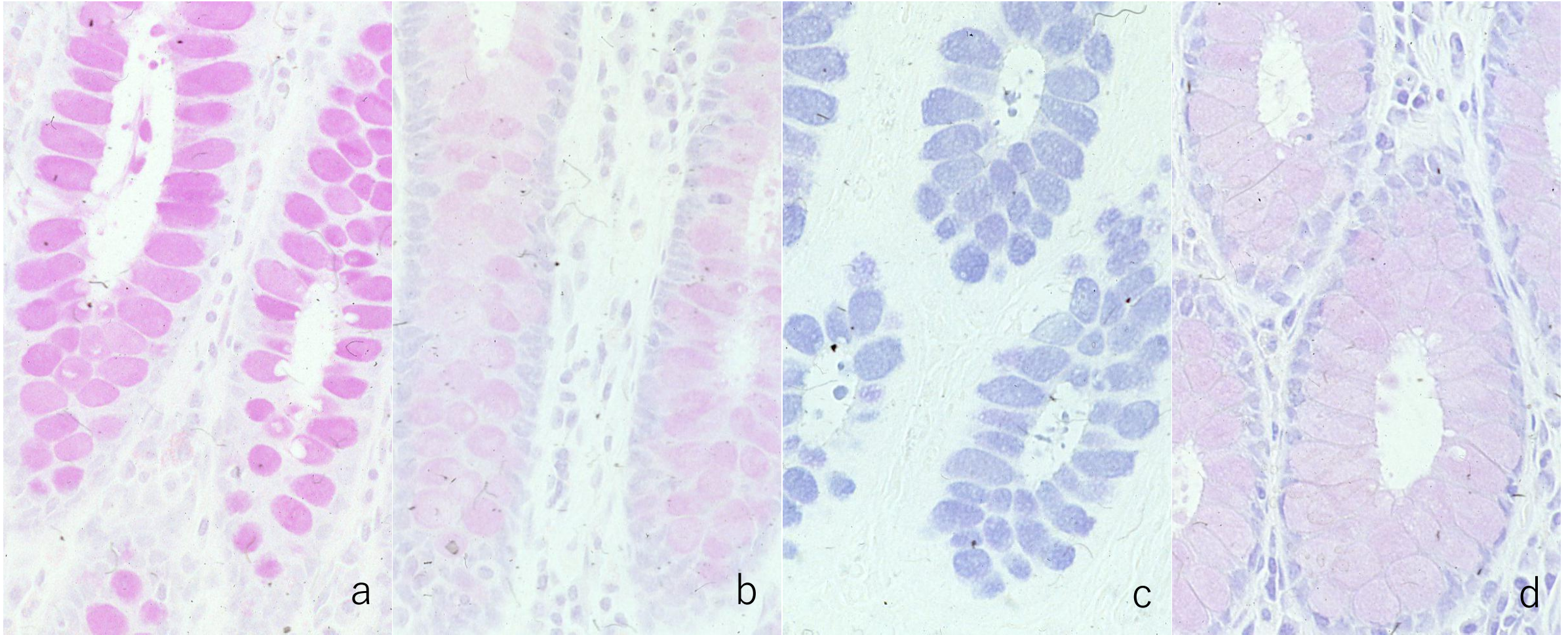
Top panel: oxidation of glucose with periodic acid (HIO_4):

Periodic acid cleaves vicinal diols to form aldehyde groups (R-CHO).

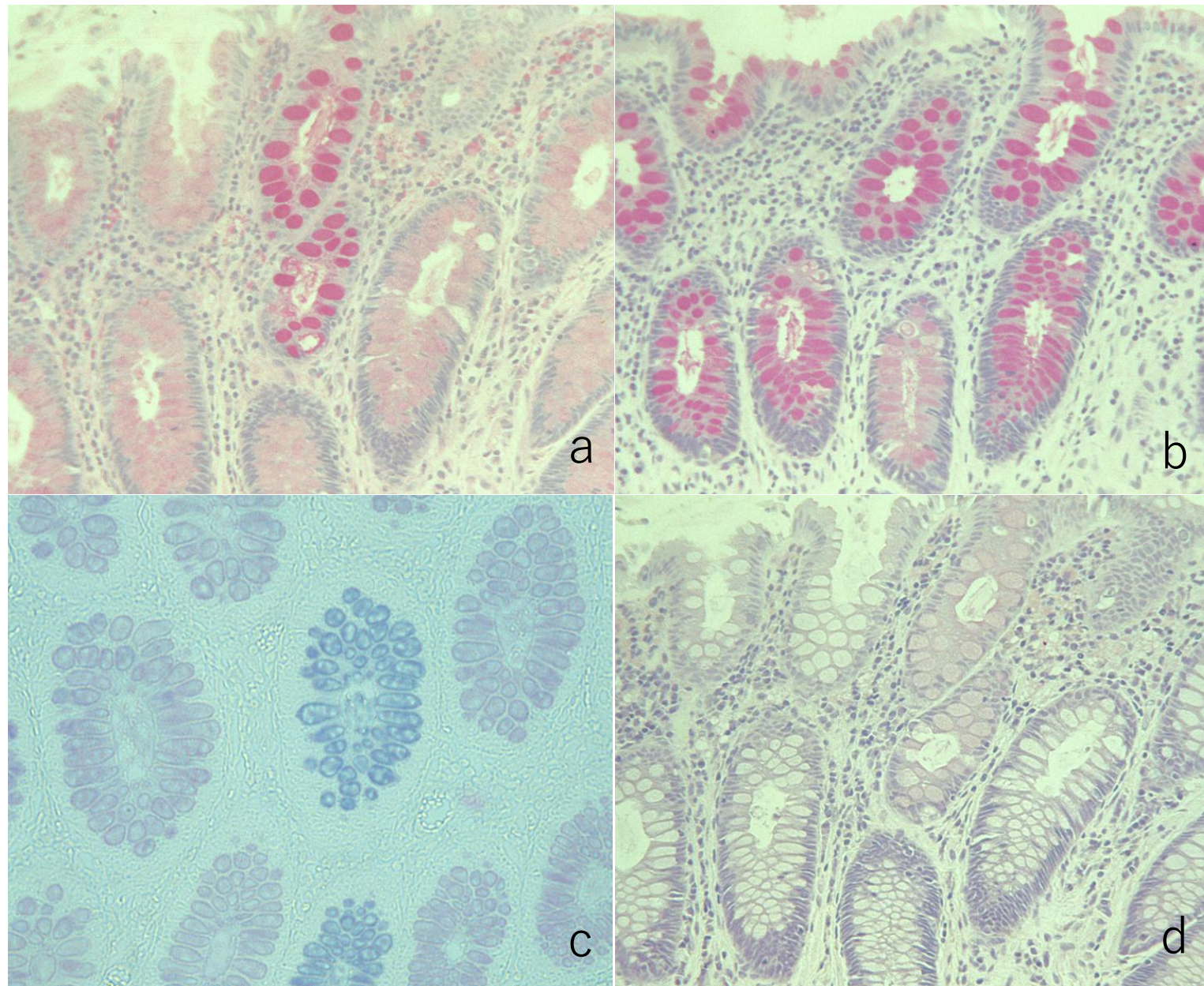
Bottom panel: formation of Schiff base with pararosaniline with sulfurous acids.



The presence of 8-O-acetylated sialic acid in normal colonic goblet cell mucin (a: PBT-KOH-PAS, b: negative control without KOH treatment). The sections were oxidized in 0.5% periodate solution for 90 min, and the aldehyde groups were reduced to hydroxide group with sodium borohydride. PAS reactivity is lost as the right panel (b) indicates. KOH treatment recovers PAS reaction as seen in the left panel (a), indicating the presence of 8-O-acetylated sialic acid.



The presence of 7-O-acetylated sialic acid in normal colonic goblet cell mucin (a: conventional PAS, b: PBT-KOH-PAS, c: PAT-KOH-PAS, d: mild oxidation-Schiff=MOS). In goblet cells containing 7-O-acetylated sialic acid in the normal colon, PAS is strongly reactive (a), PBT-KOH-PAS is weakly reactive (b), PAT-KOH-PAS stains blue (c), and MOS reaction is weakly reactive (d). NANA with three hydroxide groups on the side chain is quite susceptible to periodate oxidation, so that Schiff reactivity is obtained after very weak oxidation in 1 mM periodate in 0.1 M acetate buffer, pH 5.5 for 5 min at 0°C.



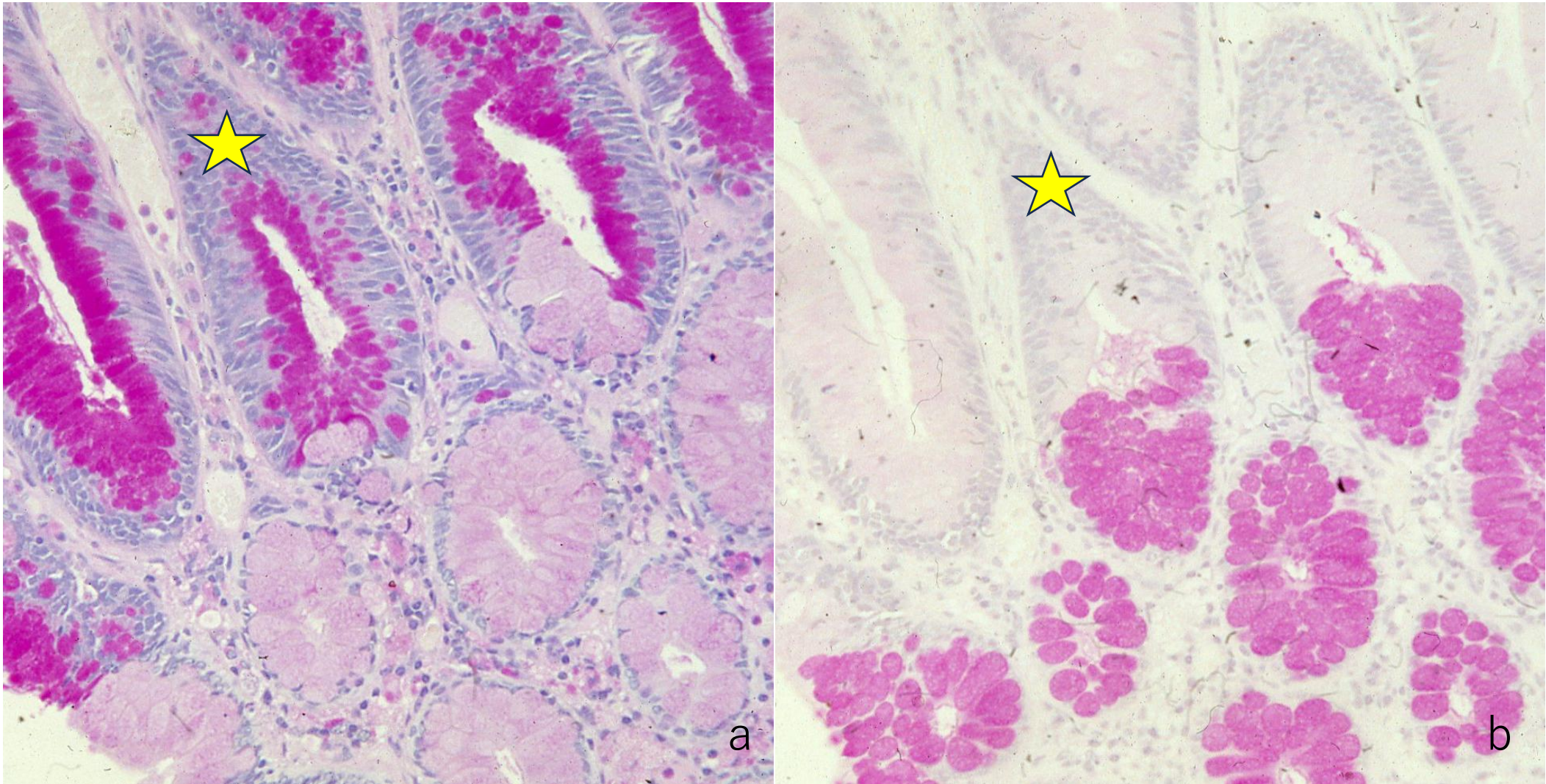
Mosaic expression of 8-O-acetylated sialic acid and 7-O-acetylated sialic acid in the normal colonic mucin (a: conventional PAS, b: PBT-KOH-PAS, c: PAT-KOH-PAS, d: mild oxidation-Schiff=MOS). Crypts in the center show goblet cells containing 7-O-acetylated sialic acid (PAS strongly reactive), while goblet cells in the surrounding crypts contain 8-O-acetylated sialic acid (PAS weakly reactive).

Histochemical staining patterns of the mucin type in the normal colon

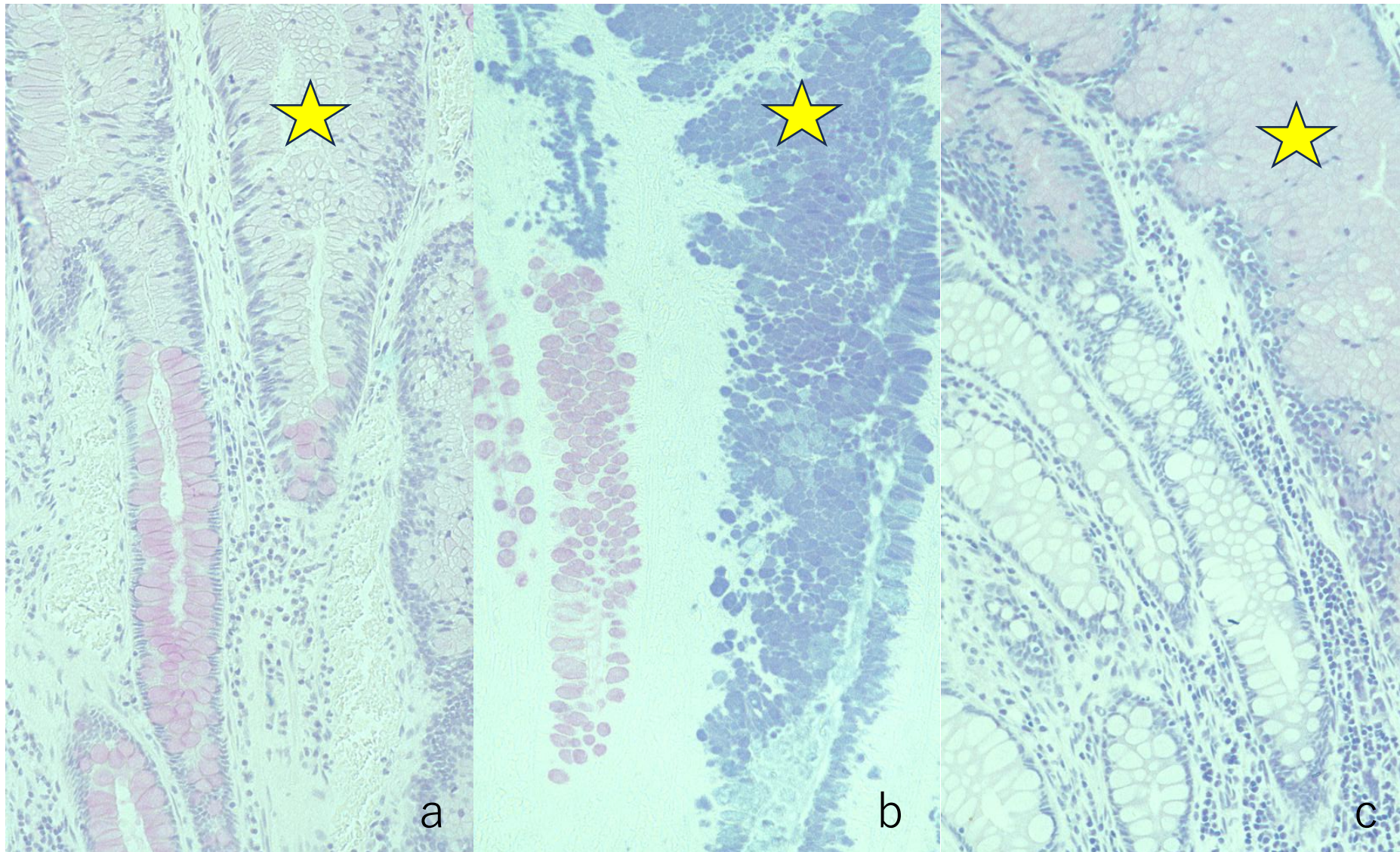
	PAS	PBT-KOH-PAS	PAT-KOH-PAS	MOS	No. of cases
C8	+	+++	red/purple	-	69 (8)
C8+C0	+++	+++	reddish blue	+	5
C7+C0	+++	+	blue	+	25
C0	+++	-	blue	+	1 (newborn)

(): mosaic pattern

*The mucin type is independent of the age, sex, site of the colon, expression of sialomucin/sulfomucin (by HID-AB staining) and ABO blood group.



PAS reaction (a) and alkaline hydrolysis-PAS reaction (b: PBT-KOH-PAS) in normal (bottom half) and adenomatous colonic mucosa (top half: asterisks). Normal goblet cell mucin is weakly reactive with PAS and becomes strongly reactive with Schiff base after alkaline hydrolysis. In contrast, neoplastic goblet cell mucin is strongly reactive with PAS, but becomes negative after borohydride treatment and alkaline hydrolysis.



Sialic acid pattern in normal (left half) and cancerous (right half, asterisks) colonic goblet cells (a: PBT-KOH-PAS, b: PAT-KOH-PAS, c: mild oxidation-Schiff=MOS). In the normal goblet cells, 8-O-acetylated sialic acid is expressed, while in the neoplastic goblet cells, non-O-acetylated sialic acid (NANA) is the major component.