

# Urine sediments and casts

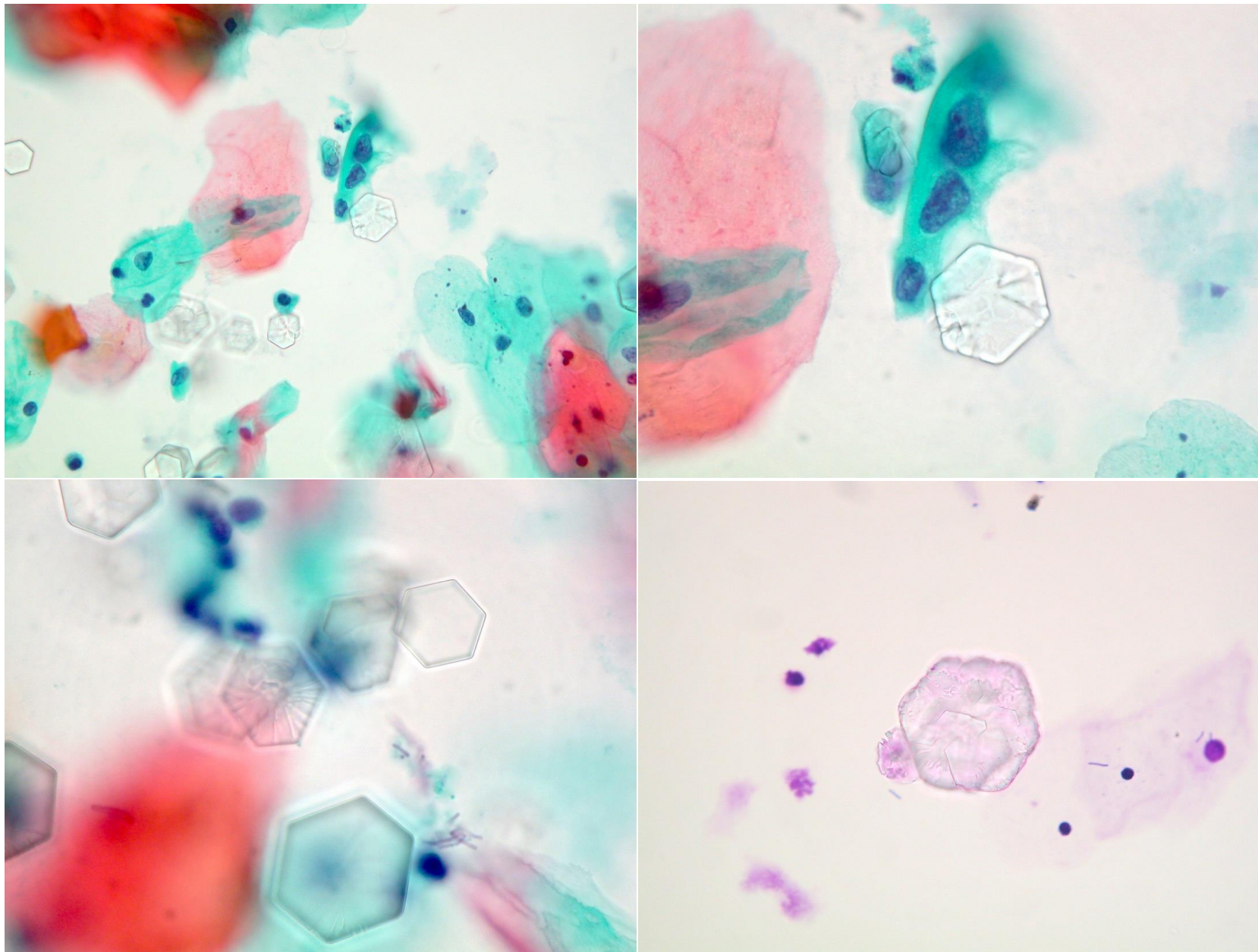
Urinary sediment examination is a non-invasive, repeatable morphological examination. The examination is necessary to accurately classify and measure urine components, such as epithelial cells, non-epithelial (blood) cells, casts, salts/crystals, and microorganisms. It is applied not only to screening the presence of lesions in the kidney or urinary tract, but also to collecting information on therapeutic and adverse effects of drugs administered to treat a confirmed lesion in the kidney or urinary tract.

# Crystals in urine sediments

- 1) Cystine crystals
- 2) Leucine crystals
- 3) DHA (2,8-dihydroxyladenine) crystals
- 4) Oxalate crystals
- 5) Calcium urate crystals
- 6) Bilirubin crystals
- 7) Ammonium-magnesium phosphate crystals
- 8) Amorphous phosphate crystals



Hexagonal, translucent and plate-shaped crystals are seen in the hemorrhagic urine. The patient is a 24-year-old student complaining of back pain due to ureteral cystine stones. The diagnosis of cystinuria can be made. Alkalinization of the urine is needed to avoid crystallization of cystine molecules.



Urine cytology for cystinuria (Papanicolaou and Giemsa). Note characteristic cystine crystals. Cystinuria is an autosomal recessive disease.



Leucine crystals in the urine (unstained preparation). They are seen in acidic urine in patients with severe hepatic failure.



The urine contains crystals of DHA (2,8-dihydroxyadenine). DHA forms yellowish brown-colored, round and tigroid crystals with small central holes. The patient suffers from adenine phosphoribosyl transferase deficiency, an autosomal recessive disease fairly common in Japanese. The main abnormalities include urinary stones and hyperuric acidemia.

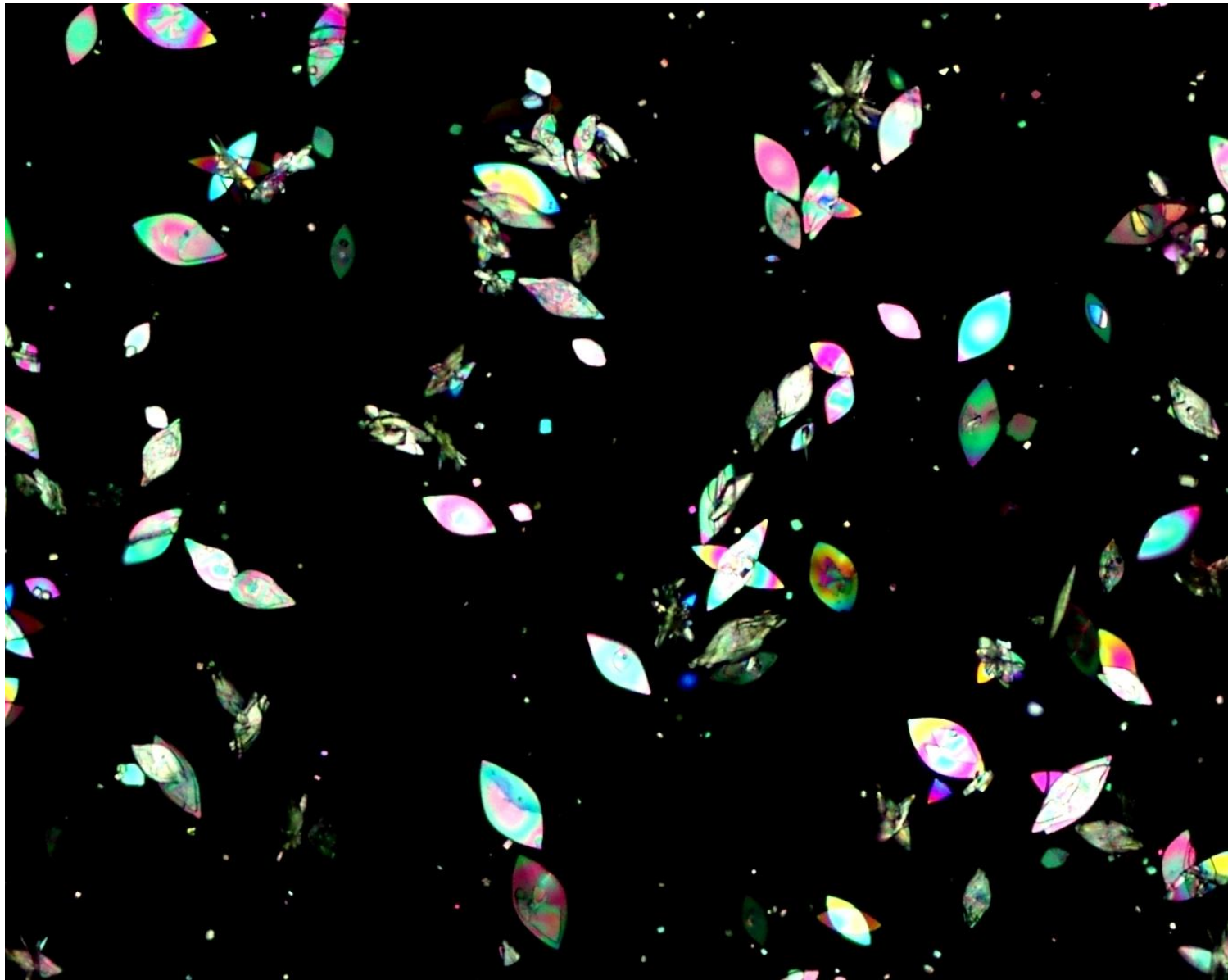


Oxalate crystals are commonly seen in the urine without pathological significance. Rectangular and translucent crystals characteristically with Maltese crossing. They are seen in acidic urine.



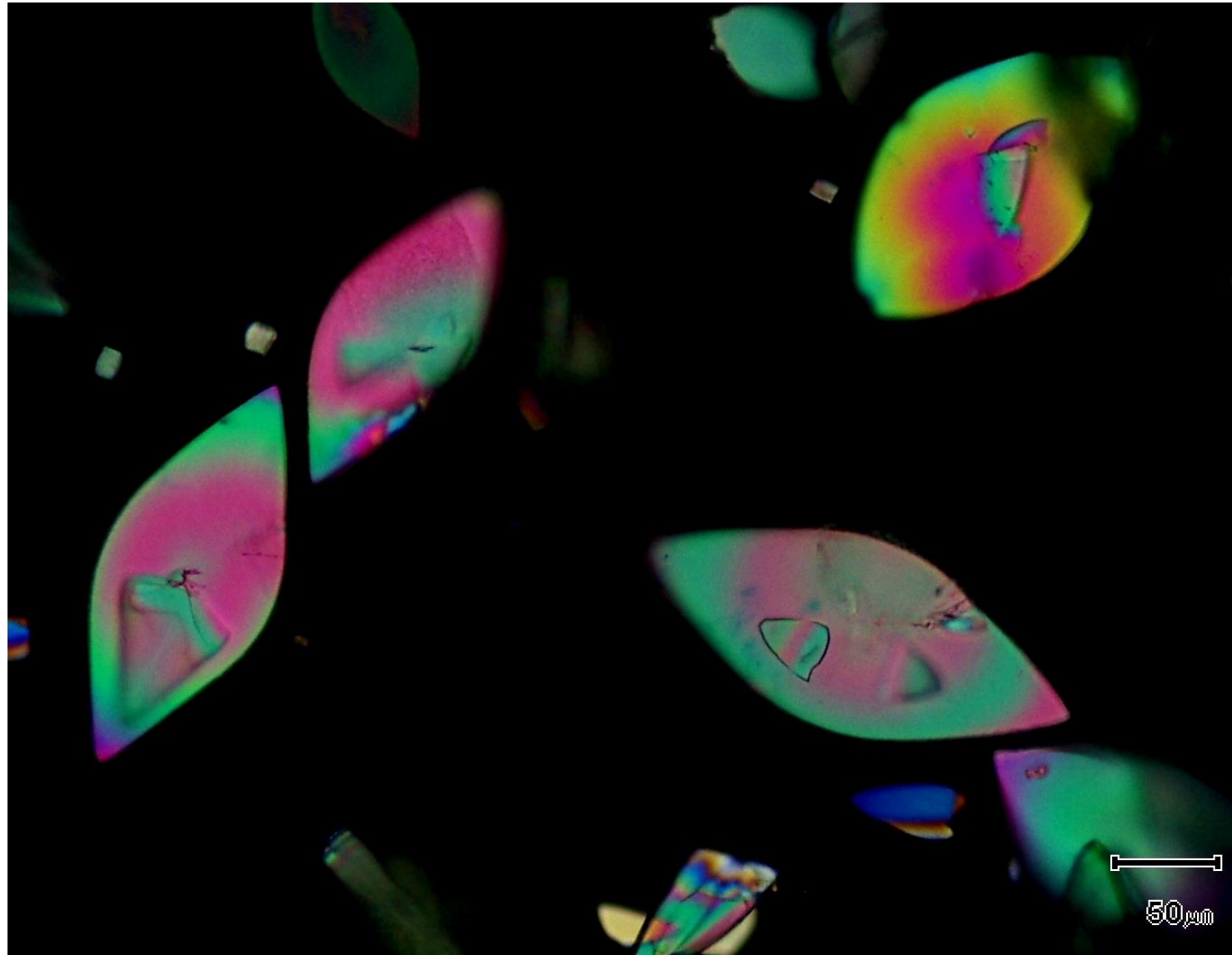
Calcium urate crystals are commonly seen in the urine without pathological significance. Rhomboid or clothespin-like crystals with yellowish brown color are formed in acidic urine.





尿酸カルシウム結晶

Compensated polarized microscopic observation of calcium urate crystals. The crystals show brilliant birefringence.

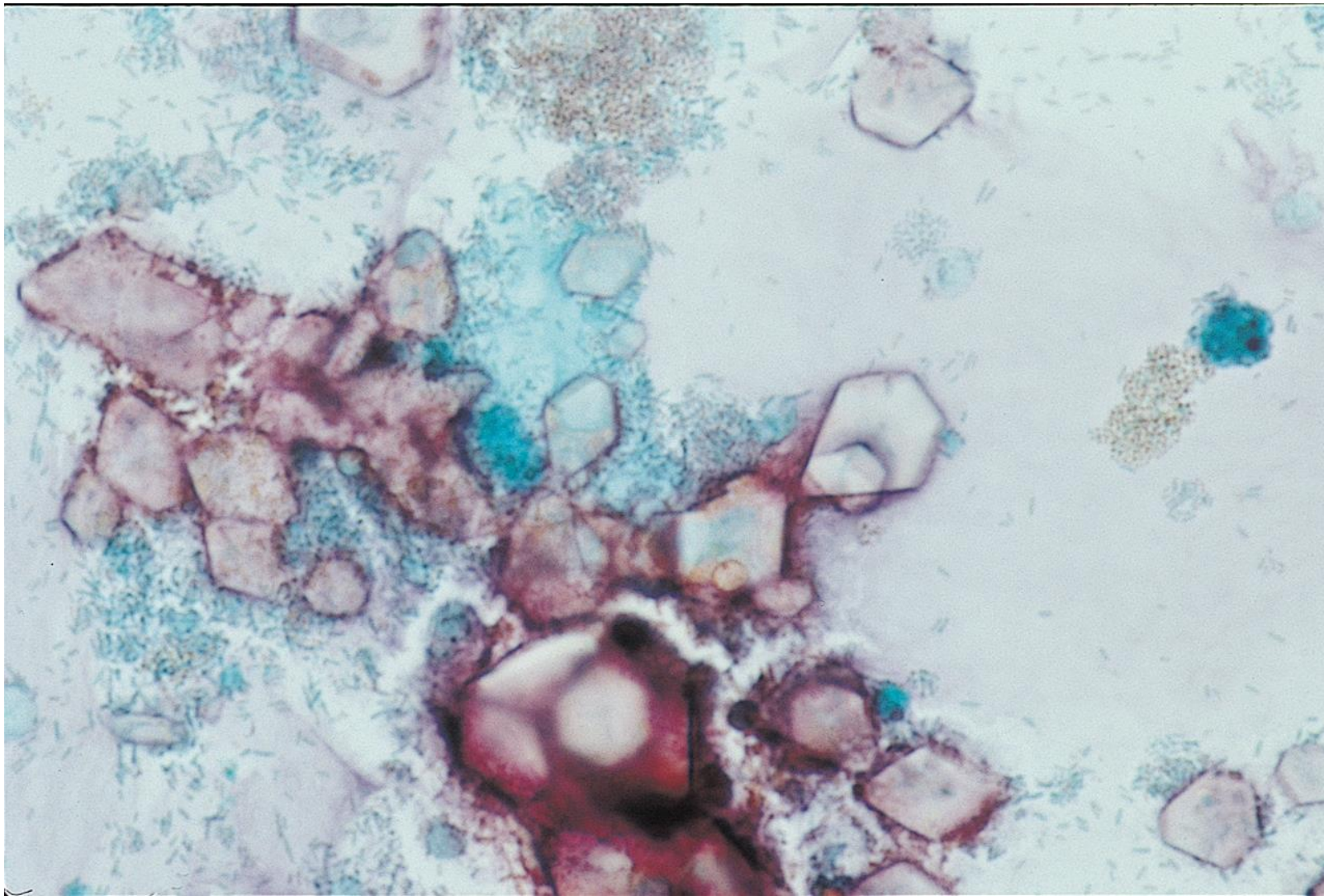


尿酸カルシウム結晶

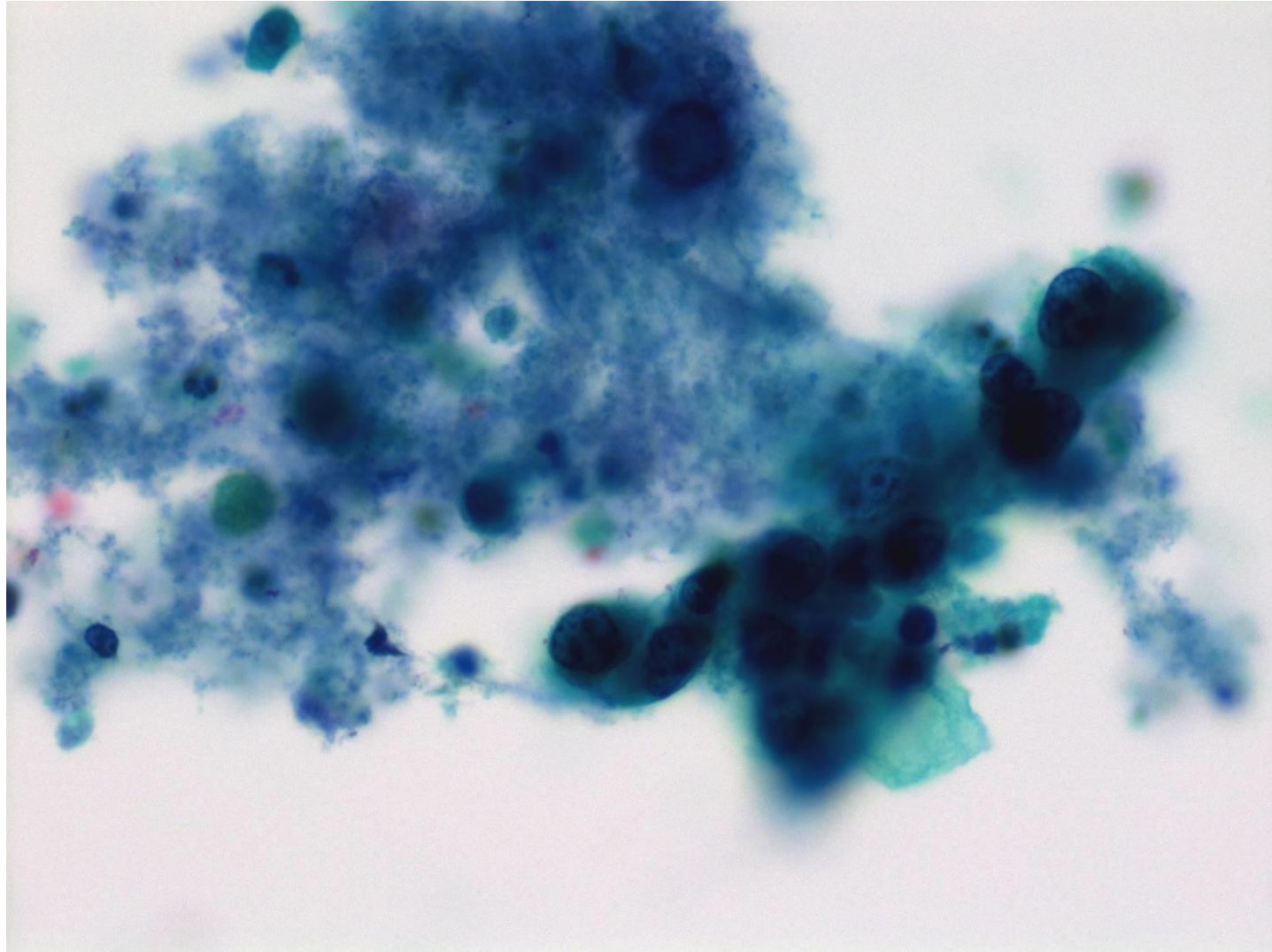
Compensated polarized microscopic observation of calcium urate crystals. The crystals show brilliant birefringence.



Bilirubin crystals in the urine. Thin needle-shaped bilirubin crystals are accumulated on the epithelial cells (intraepithelial crystals). This reflects increase of conjugated bilirubin in the urine, caused by obstructive jaundice.



Ammonium magnesium phosphate (struvite) crystals in the urine (Papanicolaou). Struvite crystallizes in the orthorhombic crystal system, as white to yellowish or brownish-white pyramidal crystals or in platy mica-like forms. The crystals are formed in alkaline urine left for hours with secondary bacterial growth. Renal infection of *Proteus mirabilis* or *P. vulgaris* promotes infection-mediated staghorn stones.

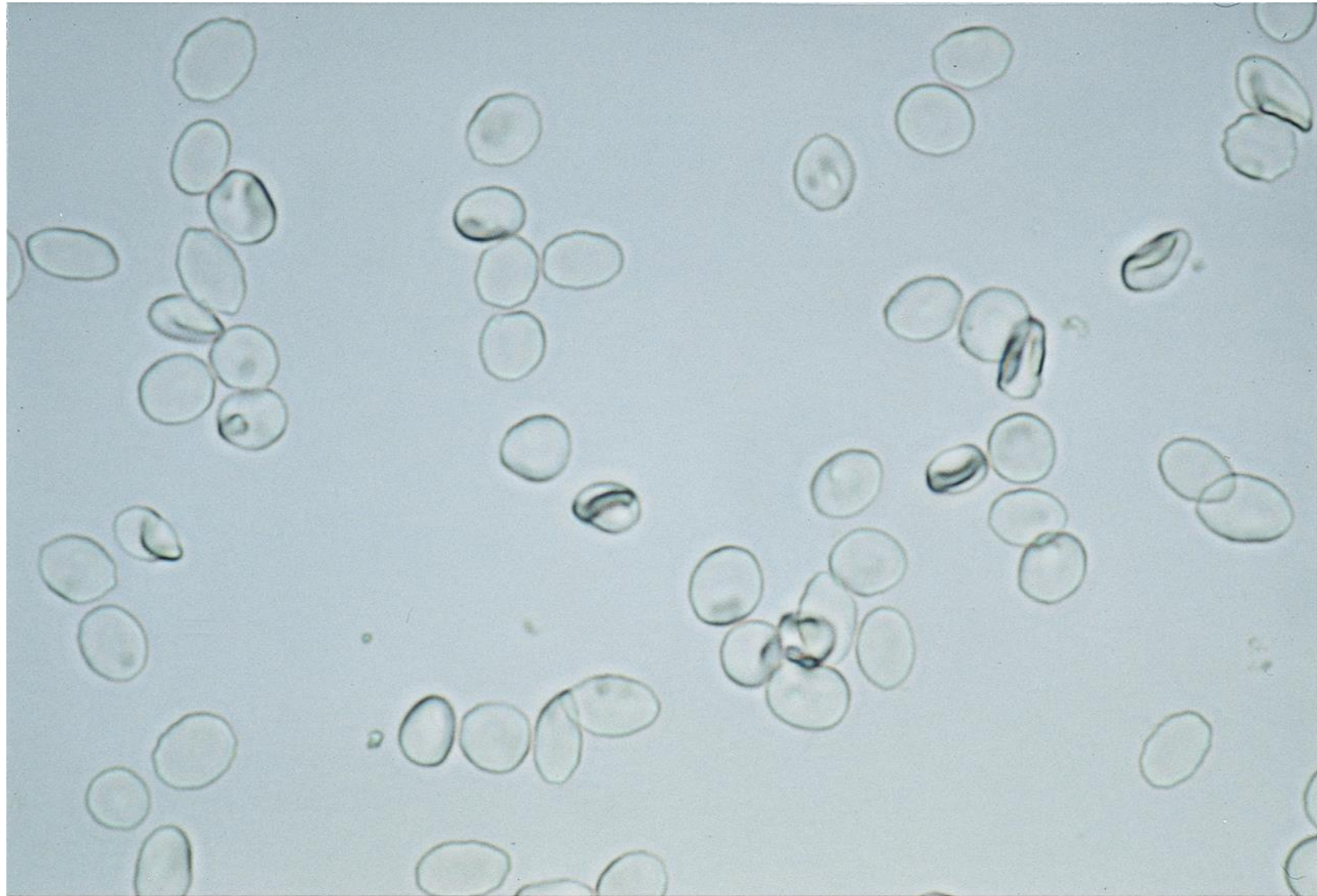


Amorphous phosphate crystals are formed in neutral or alkaline urine (Papanicolaou). Distinction from amorphous urate crystals is difficult. Amorphous phosphate crystals do not dissolve when heated at 60C, while amorphous urate crystals dissolve after heating.

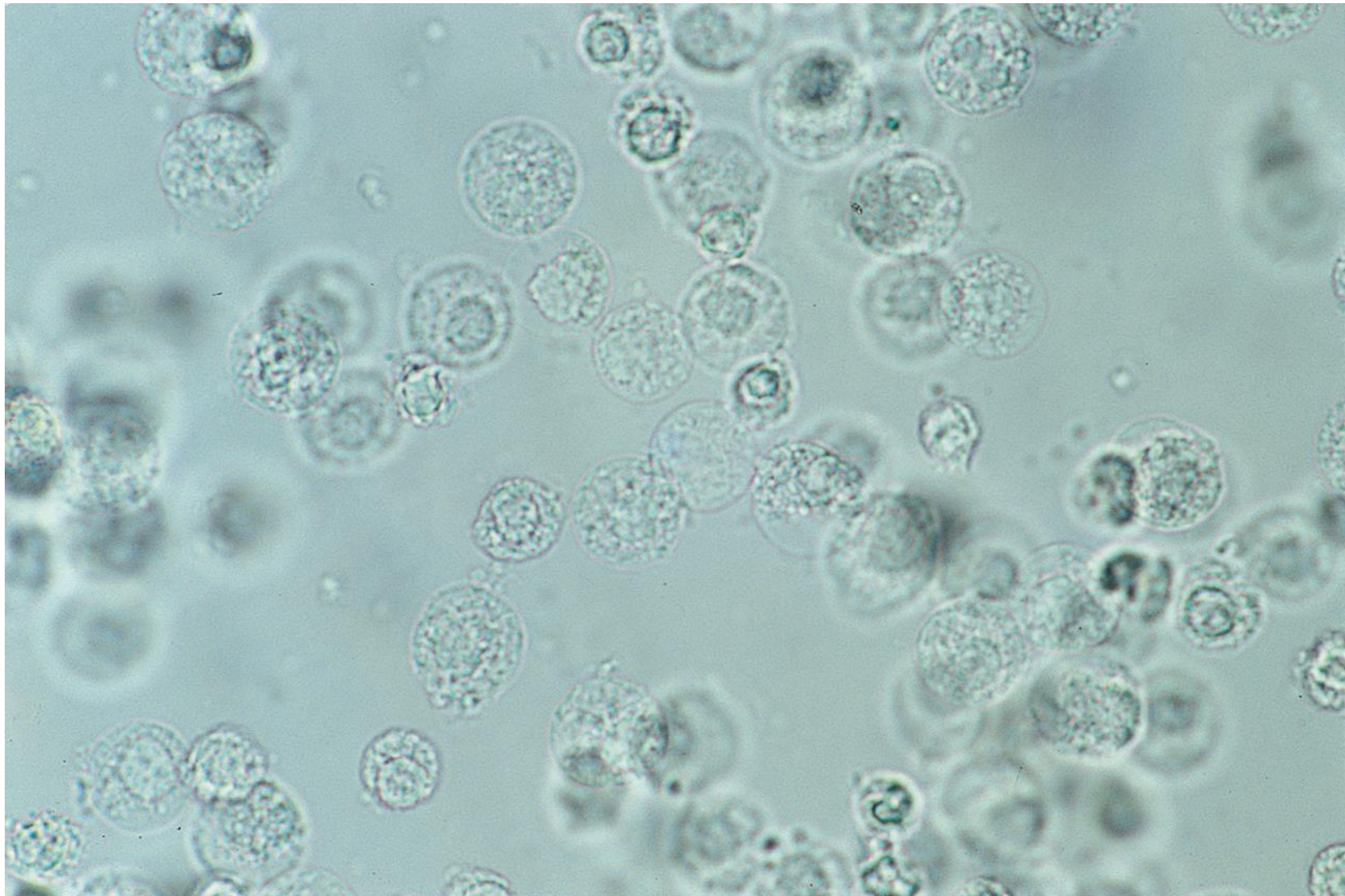
# Panel of urine sediments and casts

A variety of sediments and casts are seen in the urine. Examples are illustrated below.

- 1) Red cells
- 2) Leukocytes
- 3) Granular casts
- 4) Waxy casts
- 5) Epithelial casts
- 6) Red cell casts
- 7) Bilirubin casts
- 8) Fatty casts
- 9) Oval fat bodies
- 10) Curschmann's spirals

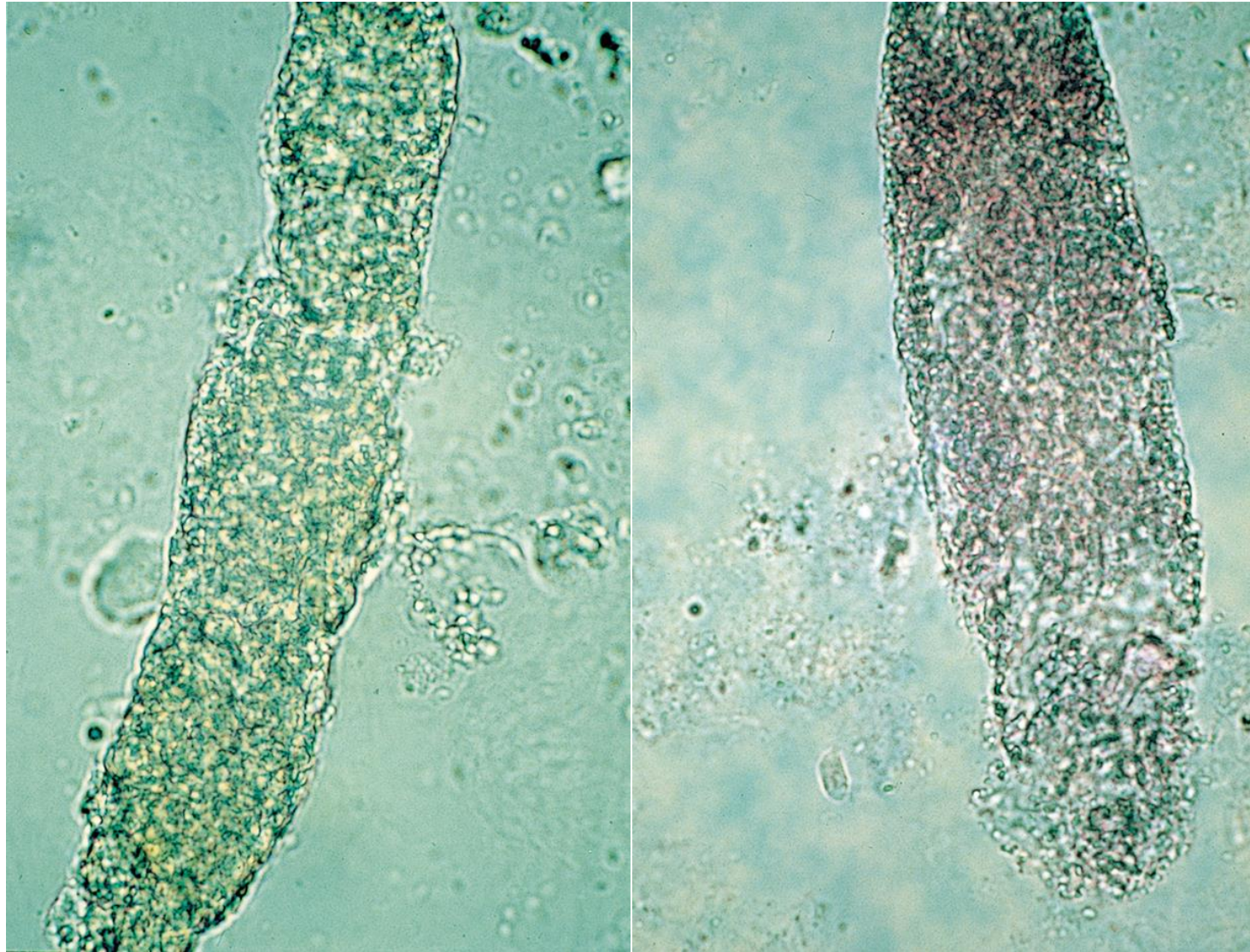


Red cells in the urine (unstained sample). The cells are not reddish in color. Centrally indented figures are observed. In adult female cases, note a menstrual period for the urinary contamination of red cells.

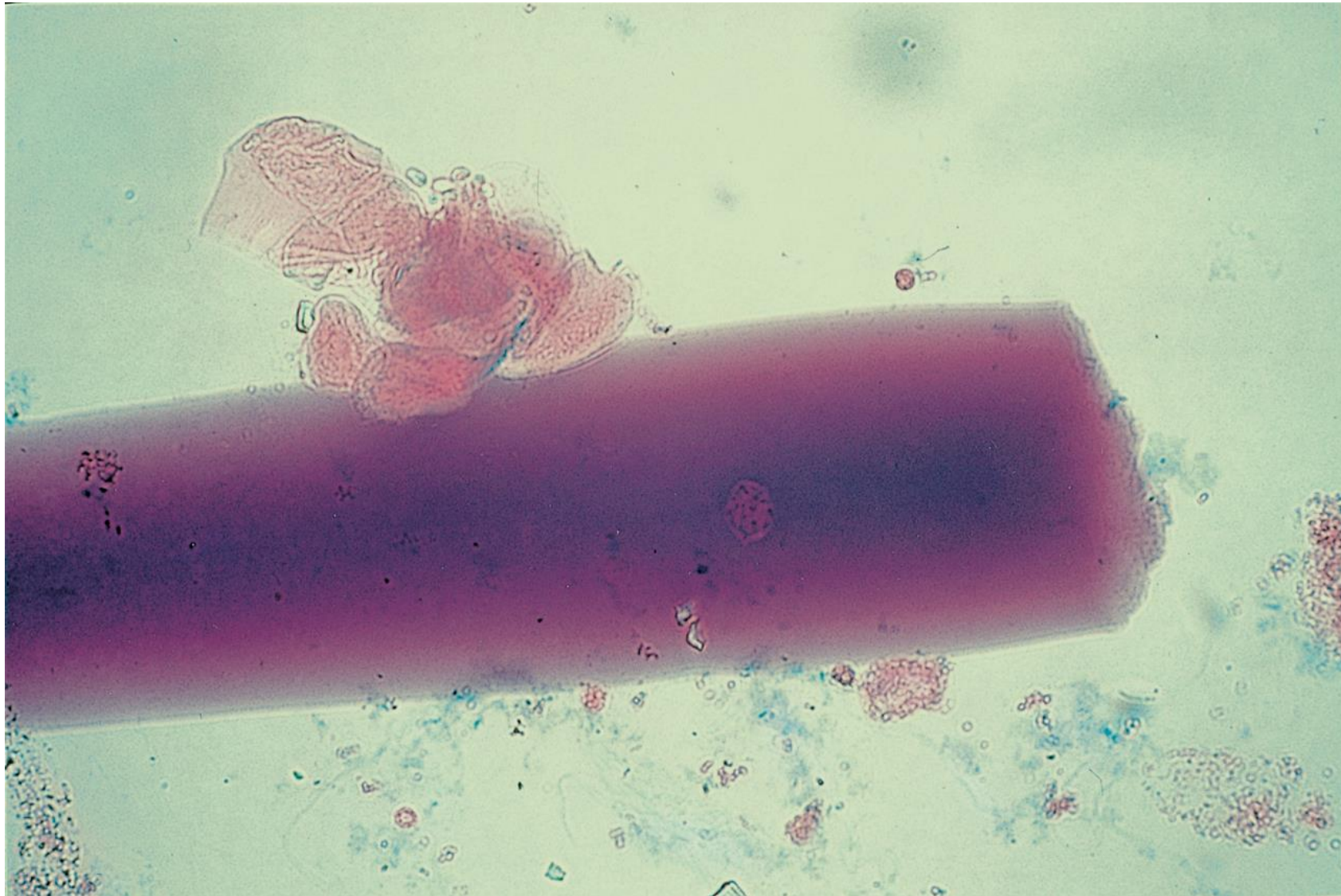


Leukocytes in the urine. Because of the presence of cytoplasmic granules, they are called as “gitter cells”. Pyuria indicates acute bacterial cystitis. Usually, bacteruria is associated.

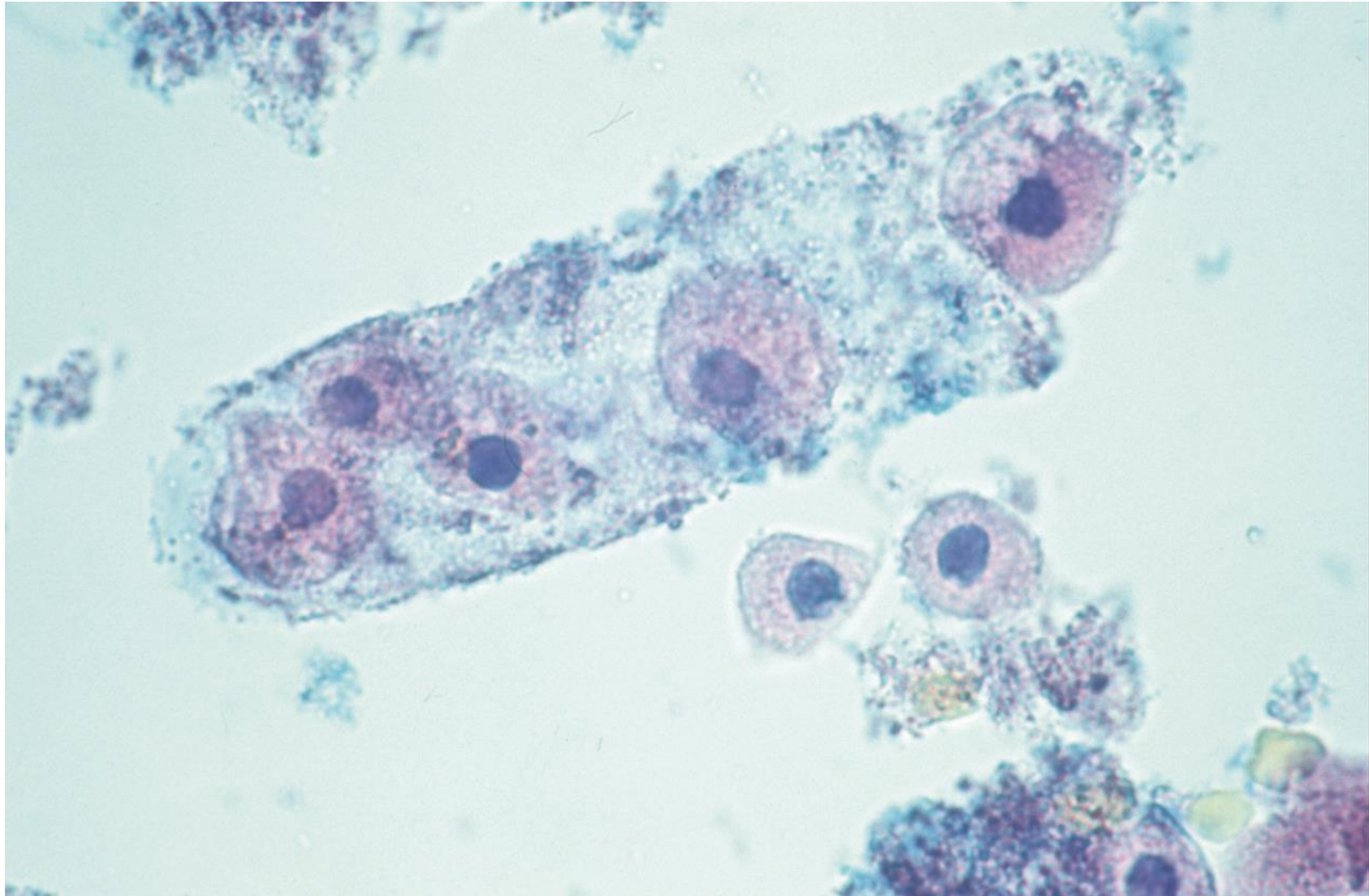




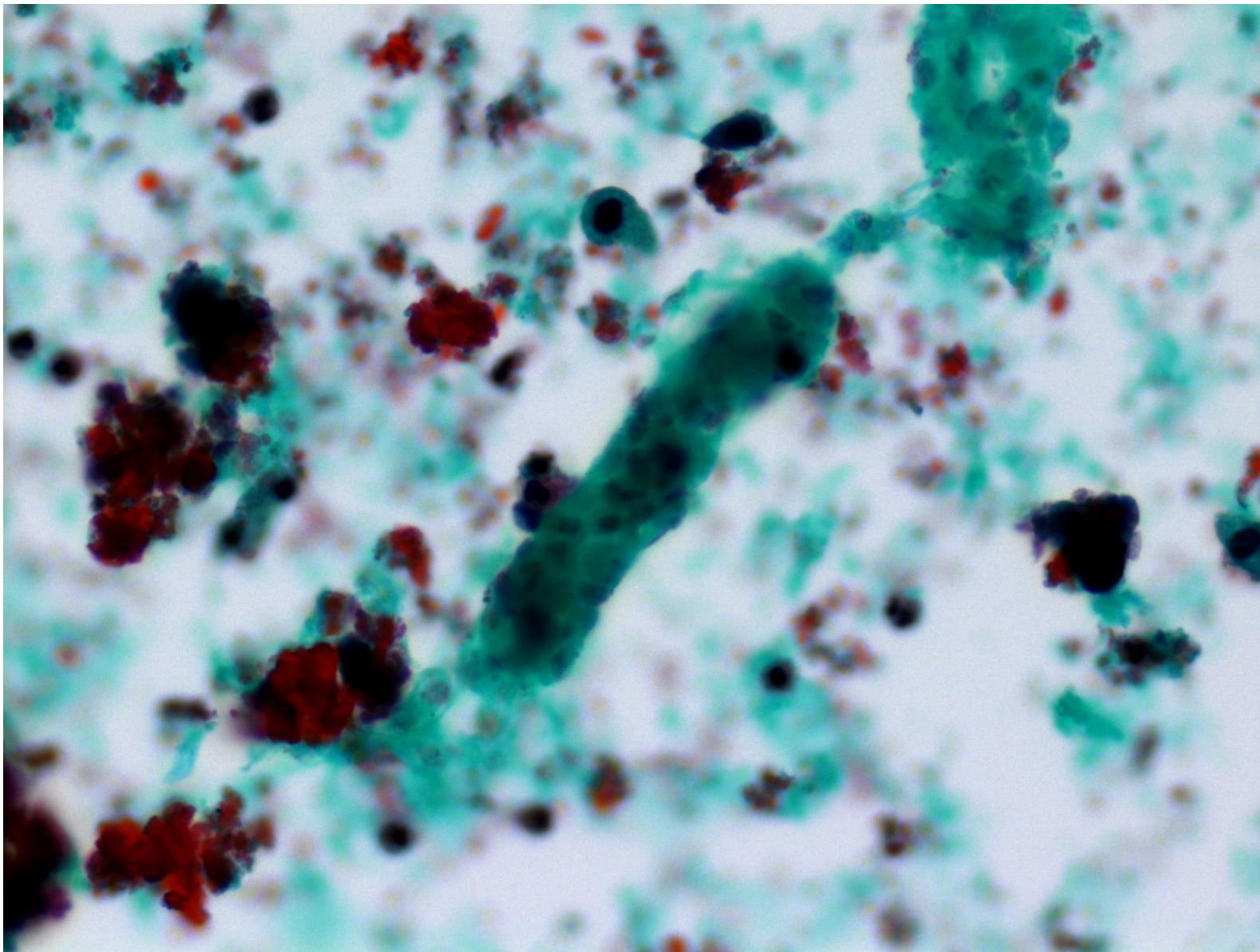
Granular casts reflect cylindrical structures formed within the distal or collecting renal tubules (left: unstained, right: Sternheimer). Granular materials are embedded in Tamm-Horsfall mucoprotein matrix. Granular casts, only mildly stained with Sternheimer method, indicate the presence of glomerulonephritis or nephrotic syndrome..



Waxy casts are thick and short cylindrical structures with highly refractive nature. Their shape can be straight, convoluted or curvilinear. They are homogeneously stained with Sternheimer method. Waxy casts are associated with chronic renal failure or severe acute tubular injury.



Epithelial casts suggests the association of acute tubular necrosis (Sternheimer). Desquamated tubular epithelial cells make the casts. Isolated columnar cells are observed in the background.



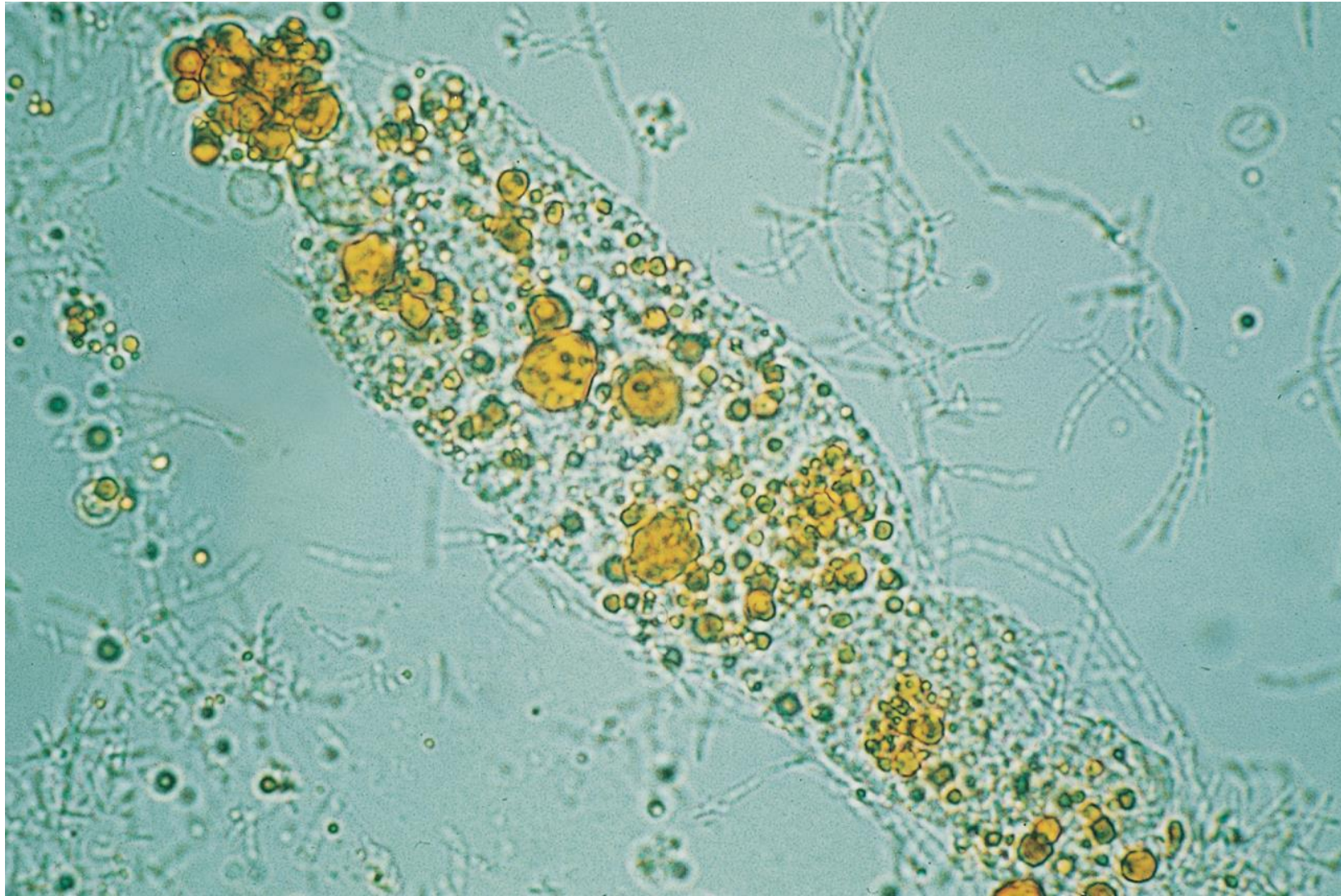
Epithelial casts in urine cytology (Papanicolaou) in a 81-year-old male patient with chronic renal failure. Epithelial debris is noted in the background.



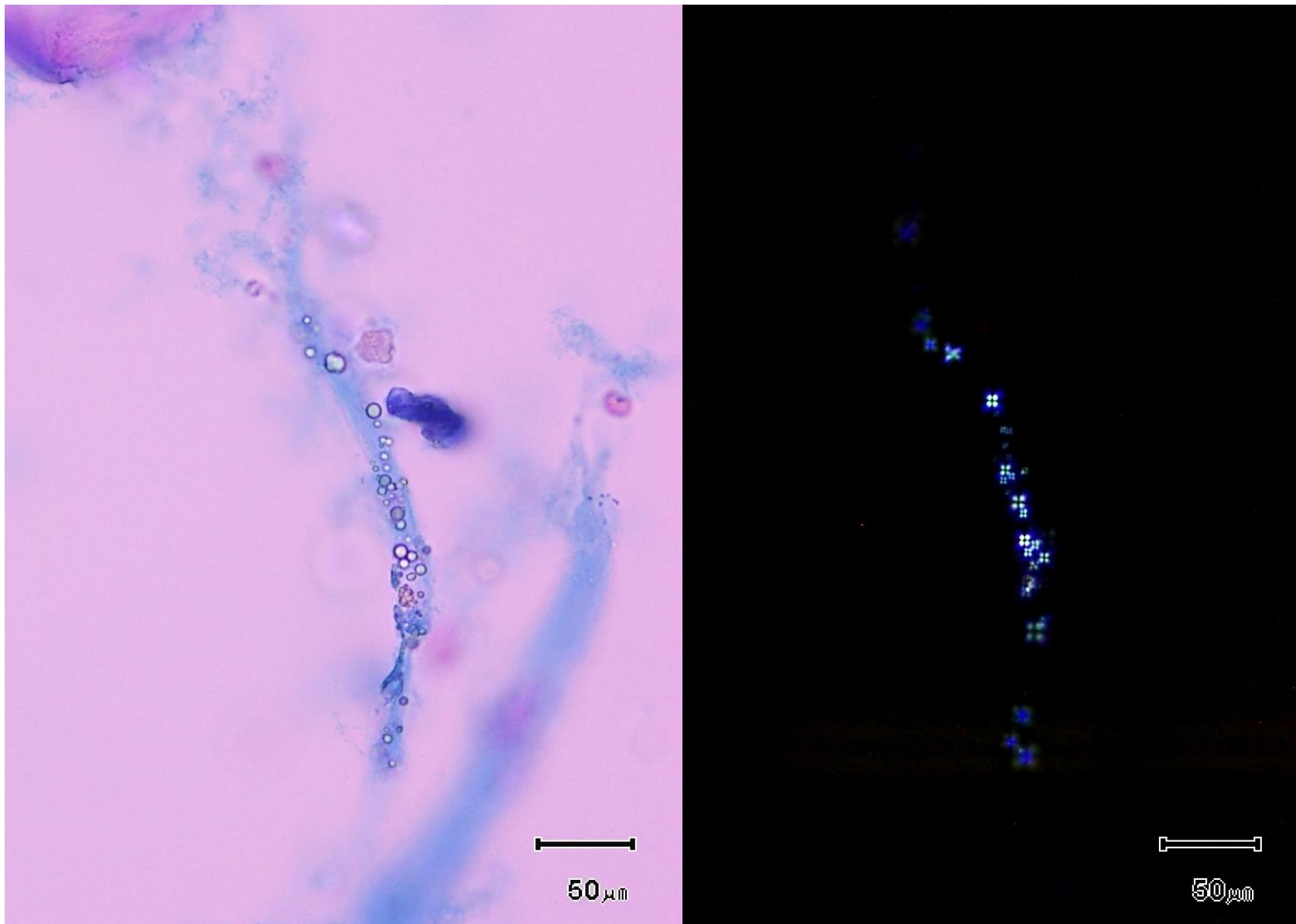
Red cell casts indicate the association of glomerulonephritis with hematuria (nephritic syndrome). They are also called as hemoglobin casts. Red cells are seen in the background. Red color is recognizable even in the unstained preparation.



Bilirubin casts represent hyaline casts stained with bilirubin of conjugated form. They are seen in cases of obstructive jaundice. Cells and crystals are also stained yellow.



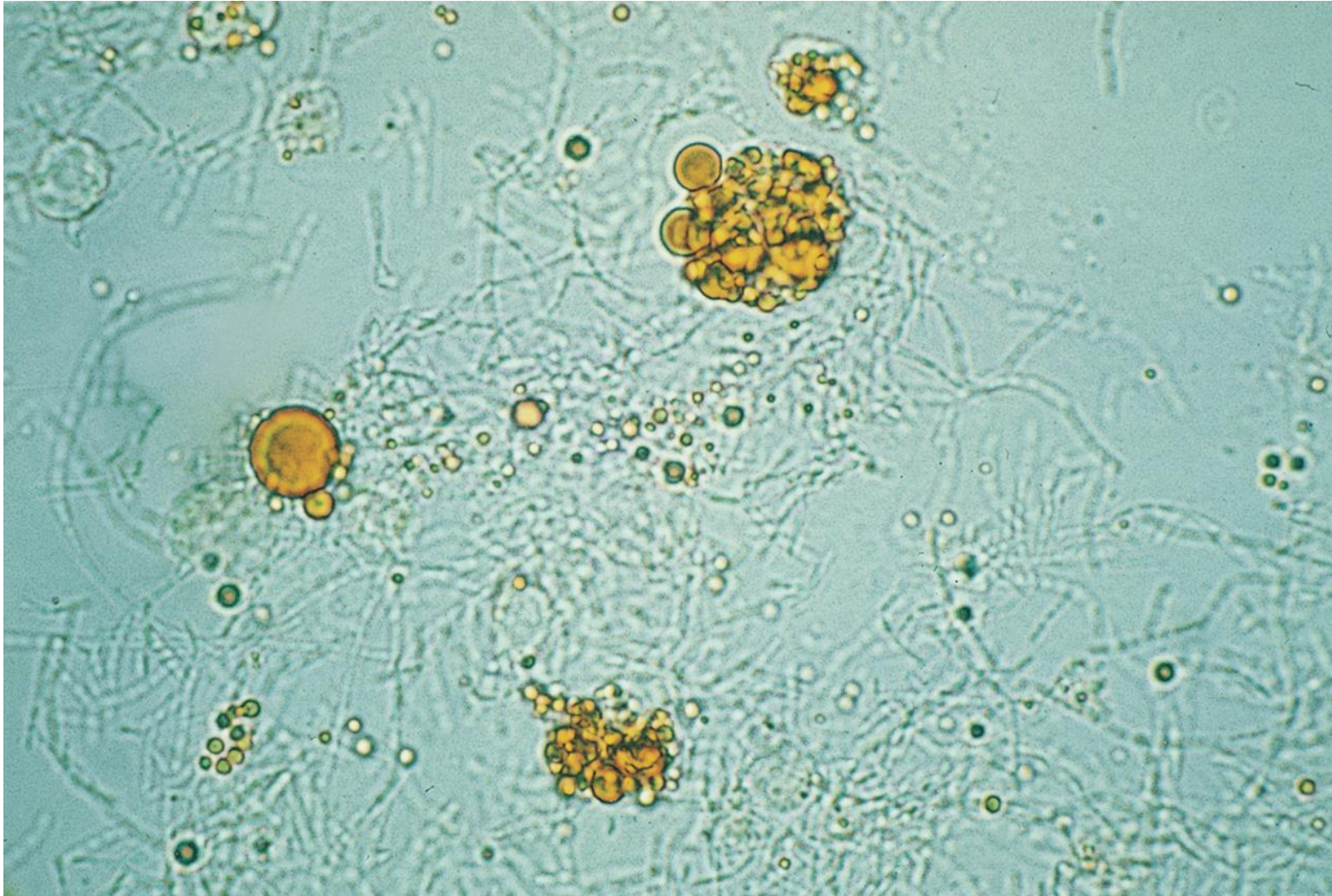
Fatty casts (Sudan III staining). Sudan III stains fat component in red. Fatty casts are seen in cases of nephrotic syndrome. Numbers of rods are seen in the background but without leukocyte reaction. Secondary bacterial growth is indicated.



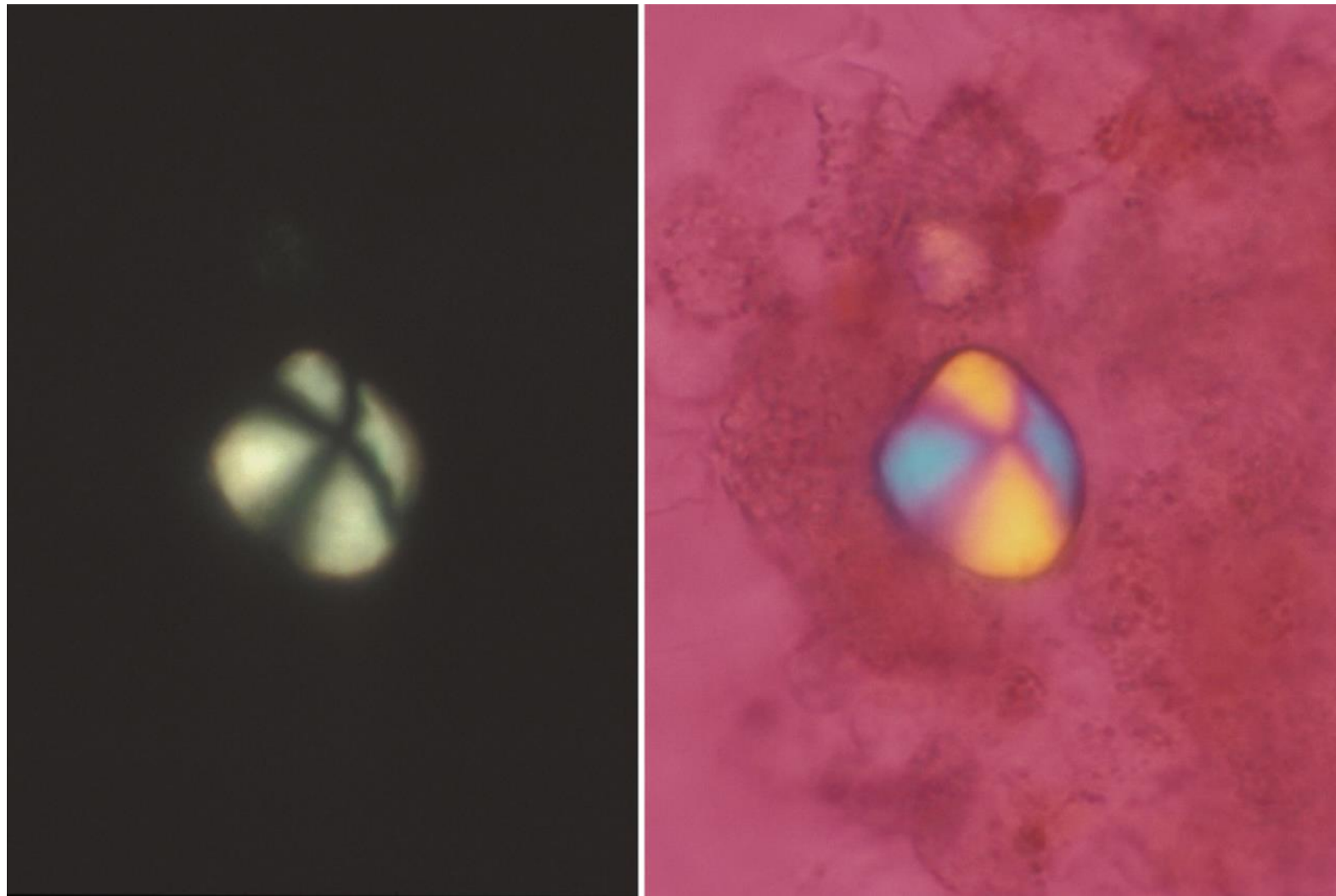
脂肪滴とマルタ十字  
(偏光観察)

Fatty casts in the urine (left: Sternheimer, right: compensated polarized microscopic observation). Brilliant fat globules are seen in the cast. Polarized microscopy indicated malthese crossing.

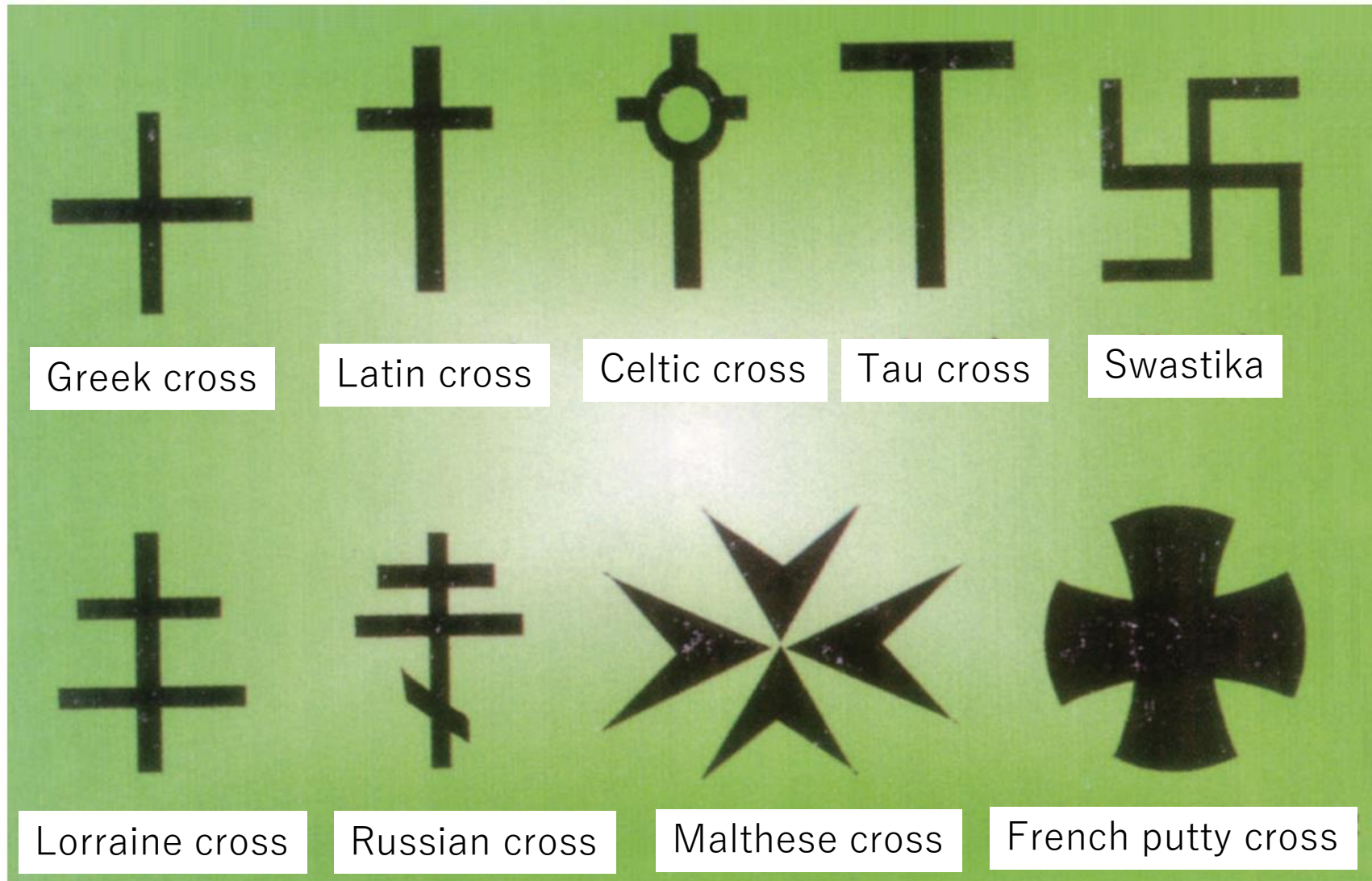




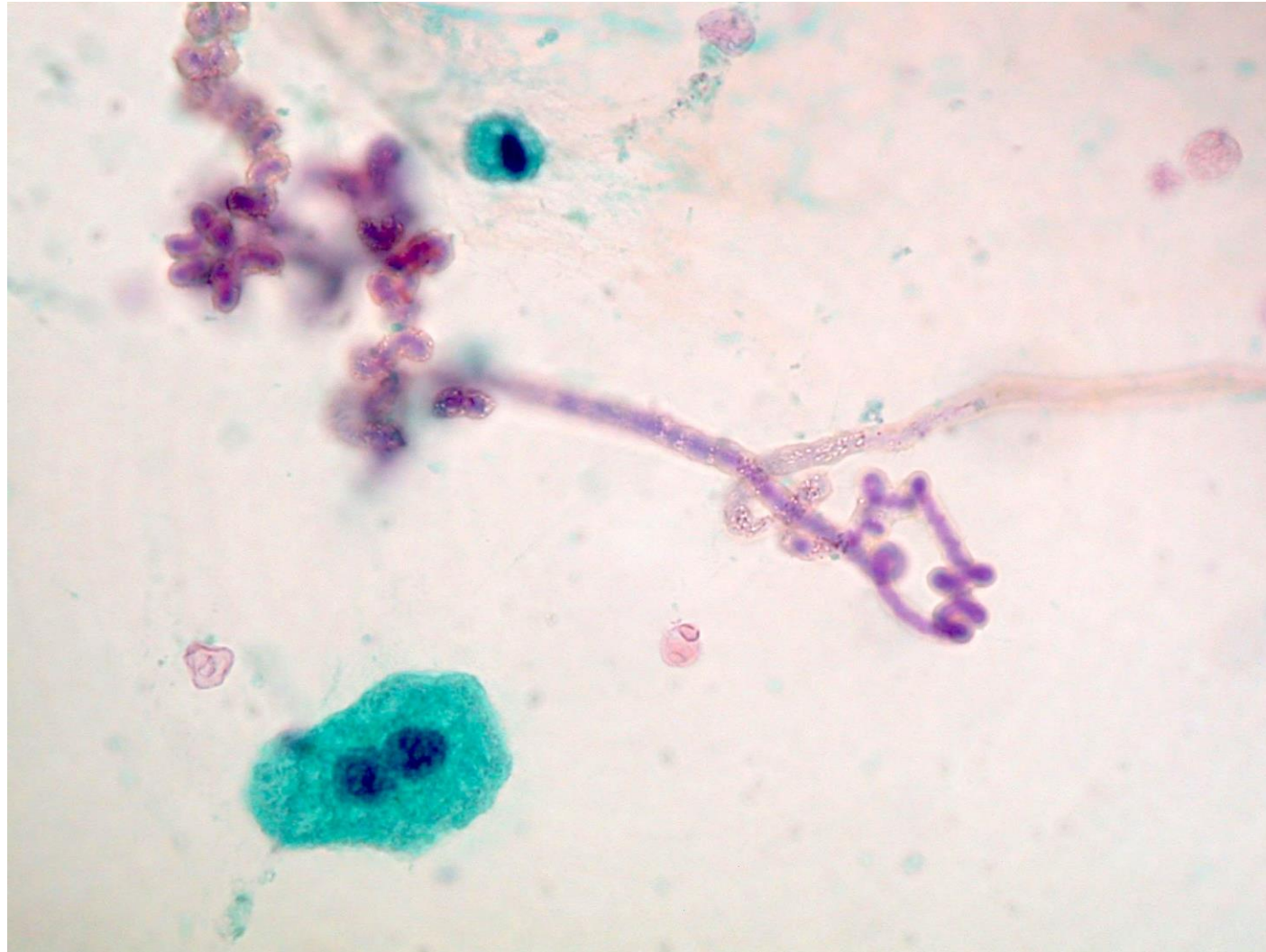
Oval fat bodies are stained reddish with Sudan III. The background small fat droplets are called as fat globules. Both indicate the association of nephrotic syndrome.



Fat globules in the urine was observed under polarized microscopy (left: regular observation, right: color-selective polarization). Note formation of malthese crossing.



Various samples of cross. The cross is a symbol of christianity (a ligious symbol).



Curschmann's spirals are a microscopic finding in the sputum of asthma and chronic bronchitis. They are spiral-shaped mucus plugs secreted from bronchial mucous gland. The same structures may be seen in the uterine cervical smears and in the urine preparations. In the urine, they derive from secretion of Cowper's bulbourethral gland (male) or Bartholin's gland (female).