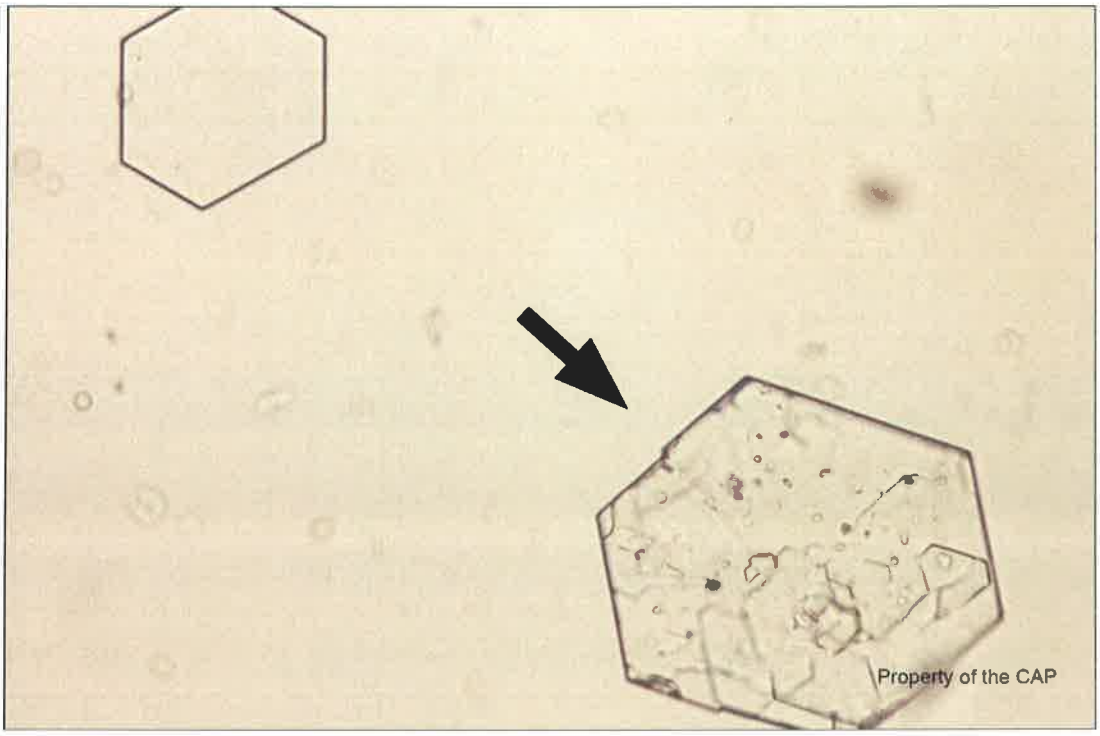
Urine Sediment Photographs

Case History CMP-04 through CMP-06

This urine specimen is obtained from a 35-year-old man seen in the emergency room for kidney stones. Laboratory data include: specific gravity = 1.022; pH = 5.0; blood, protein, and leukocyte esterase = positive; glucose, ketones, and nitrite = negative.

CMP-04



(URINE, UNSTAINED, HIGH POWER)

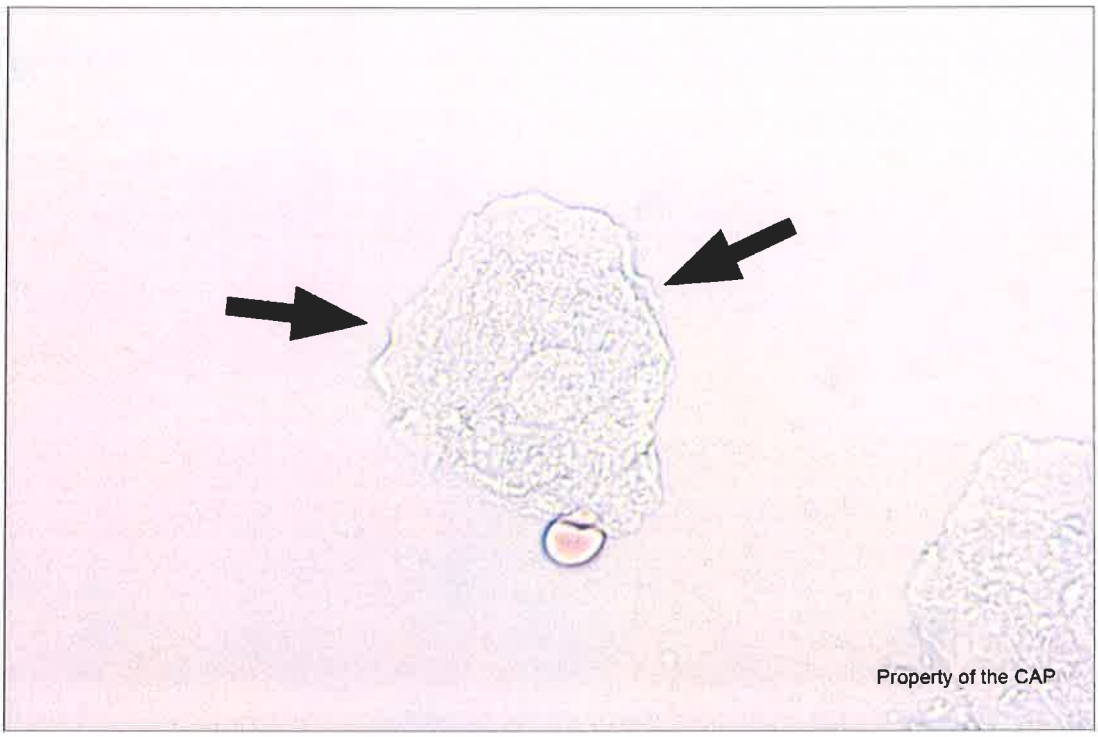
Identification	CMP Participants No.	%	Performance Evaluation
Cystine crystals	5580	97.3	Good

The object indicated by the arrow is a cystine crystal, as correctly identified by 97.3% of participants. Cystine crystals are found in acid urine and are characterized by hexagons of variable size with partial lamination. Cystine crystals are colorless, with colorless or absent birefringence. Cystine crystals are abnormal and associated with cystinuria. Cystinuria is an autosomal recessive genetic condition associated with urinary tract damage and formation of urinary tract stones in adults and children. 1 - 2% of stones in adults and 6 - 8% of stones in children are composed of cysteine.

Occasionally, cystine and uric acid crystals may look alike. Distinguishing between the two is clinically important and can be accomplished with a nitroprusside test; the nitroprusside reaction is positive with cysteine.

Urine Sediment Photographs

CMP-05



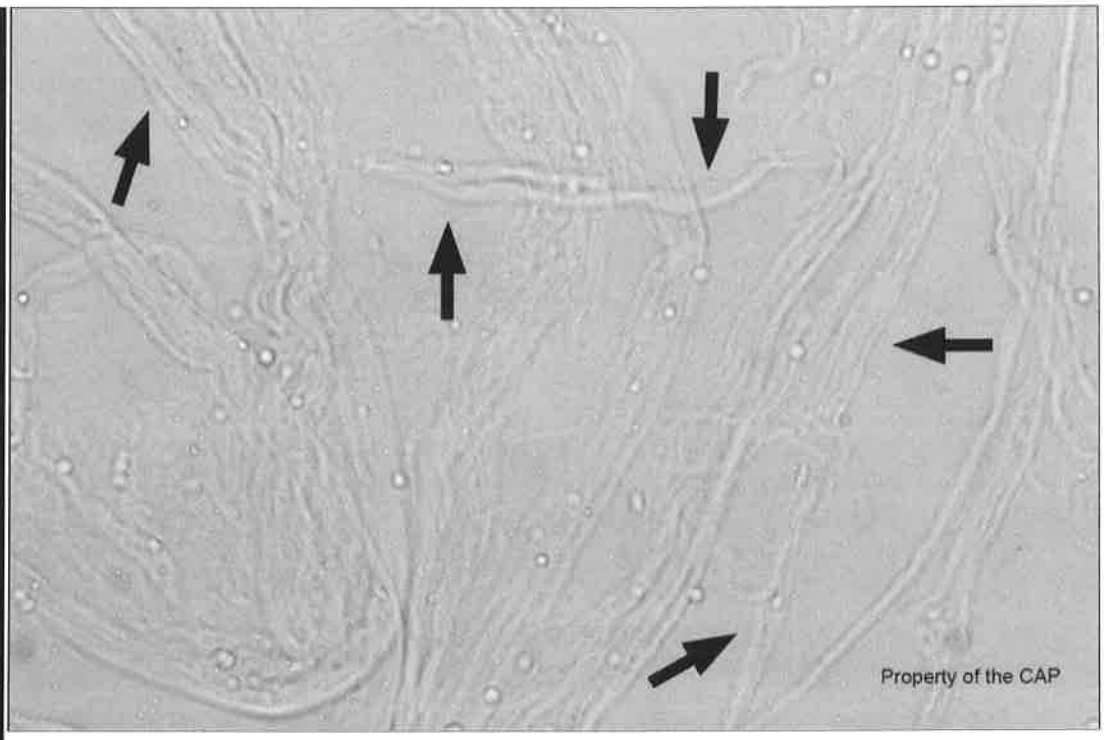
(URINE, UNSTAINED, HIGH POWER)

Identification	CMP Participants No.	%	Performance Evaluation
Squamous epithelial cell	5093	88.8	Good

The cells indicated by the arrow are squamous epithelial cells, as correctly identified by 88.8% of the participants. Squamous cells are the most common lining cell of the urinary tract, and are a normal finding in urine. Squamous cells are large (30 - 50 µm), flat, polygonal and thin. The nucleus is small, round and centrally located. The cytoplasm is colorless and may contain a few keratohyaline granules. The presence of large numbers of squamous cells indicates that the specimen was not a "clean catch."

Urine Sediment Photographs

CMP-06



(URINE, UNSTAINED, HIGH POWER)

Identification	CMP Participants No.	%	Performance Evaluation
Mucus strand	5635	98.4	Good

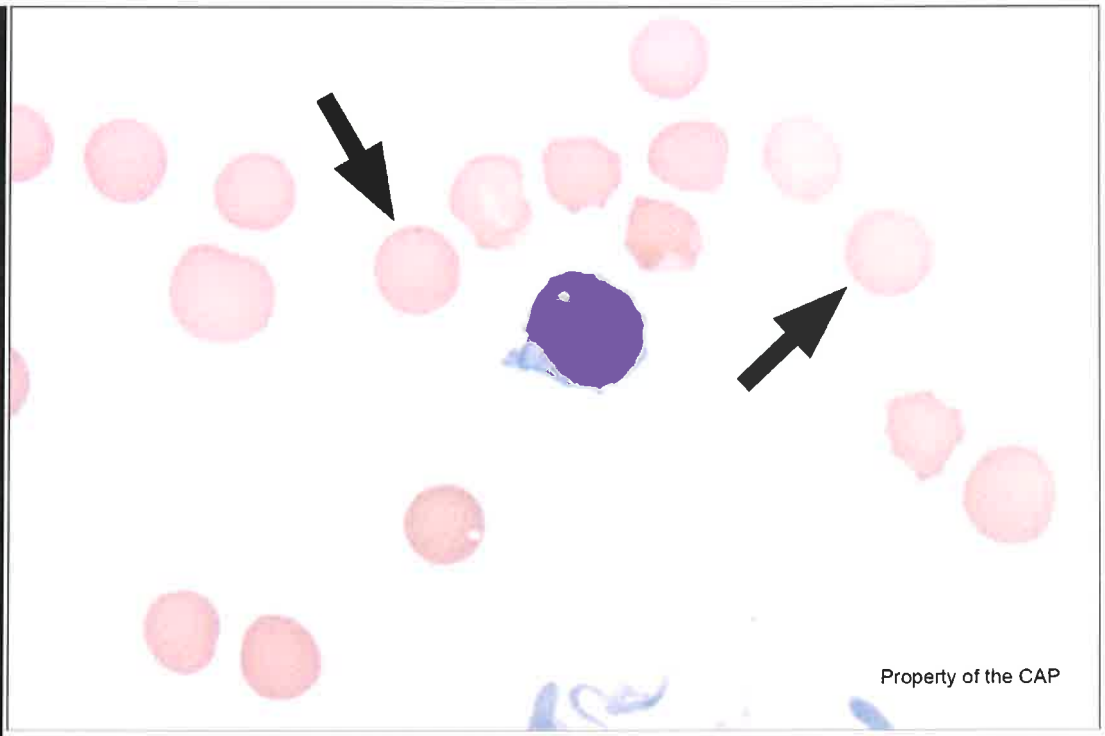
The objects indicated by the arrows are mucous threads, as correctly identified by 98.4% of the participants. Mucous threads, or strands, are a contaminant of urine specimens that originates in vaginal and lower urinary tract glands. Mucous strands are delicate, translucent, elongated structures that may be intertwined. Mucous threads should not be confused with fungi, casts or fibers. Mucous threads are variable with no structural details.

Body Fluid Photographs

Case History CMP-07 through CMP-09

This patient is a 58-year-old woman with a history of Hodgkin lymphoma status post radiation and chemotherapy. Pleural fluid specimen laboratory findings include: WBC = 262/µL (0.262 x 10E3/µL); RBC = 11,300/µL (11.300 x 10E3/µL).

CMP-07



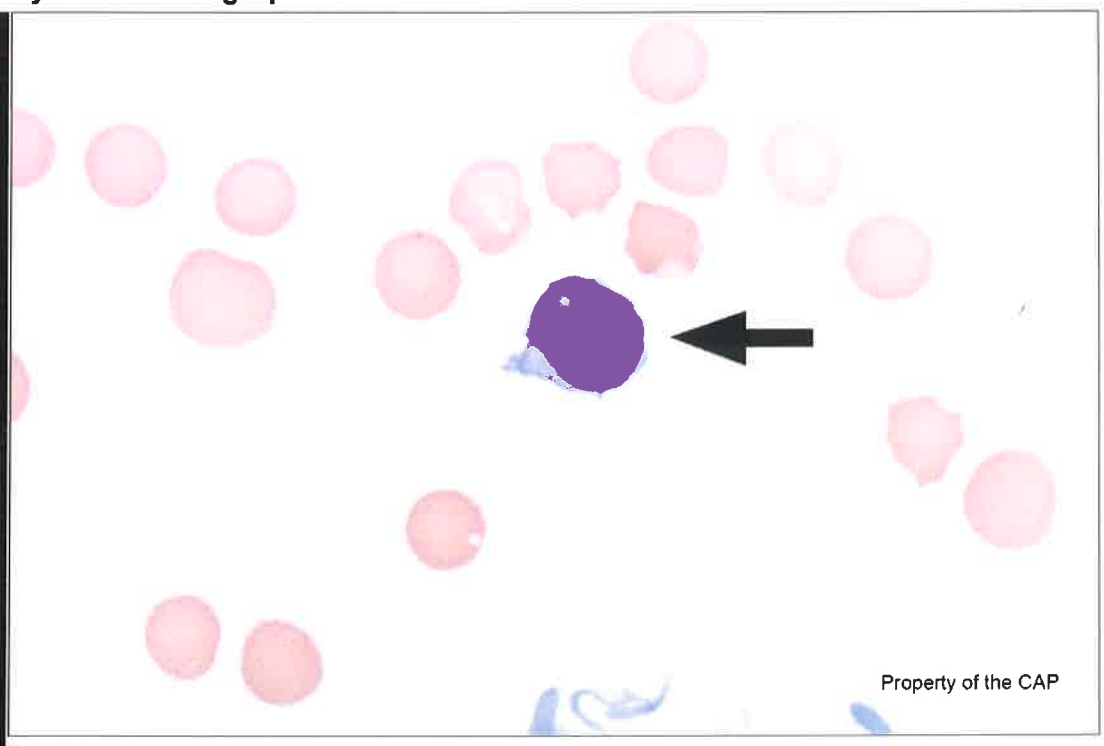
(PLEURAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Erythrocyte	3534	99.6	Good

The arrowed objects are erythrocytes, as correctly identified by 99.6% of participants. Erythrocytes lack a nucleus and are characterized by a circular outer contour and pink-red, homogenous agranular cytoplasm. Erythrocytes classically show a round, central zone of pallor due to their biconcave disc cell shape; however, the zone of central pallor may be inconspicuous in body fluid preparations. Normal erythrocytes show minimal variation in size. The cell diameter is approximately 7 µm. The presence of erythrocytes in body fluids is abnormal and represents hemorrhage or traumatic contamination.

Body Fluid Photographs

CMP-08



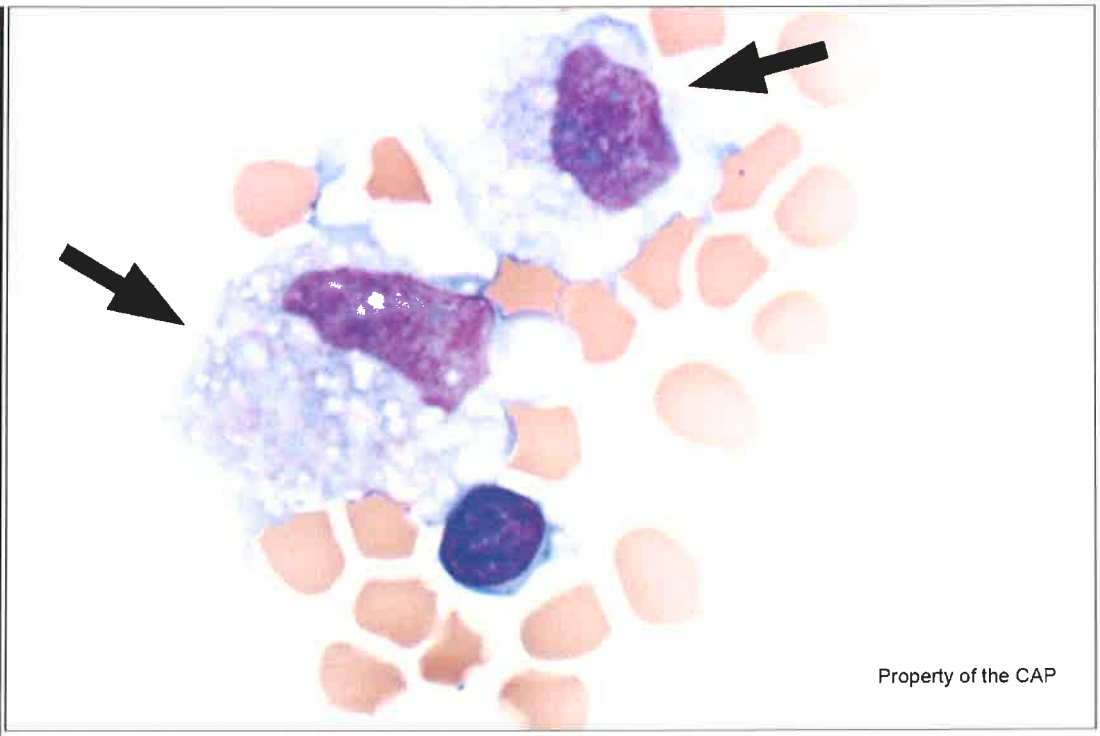
(PLEURAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Lymphocyte	3344	94.2	Good

The arrowed object is a lymphocyte, as correctly identified by 94.2% of participants. This lymphocyte exhibits a characteristic single, round nucleus with clumped nuclear chromatin and a high nuclear to cytoplasmic (N:C) ratio of approximately 5:1. The cytoplasm is scant and pale blue. The small size, clumped chromatin and high N:C ratio help to distinguish this resting lymphocyte from a reactive lymphocyte. Small nucleoli are visible here. Nucleoli may appear falsely accentuated in normal, non-reactive lymphocytes of body fluids as an artifact of cytocentrifuge preparation and should not be over-interpreted as a sign of neoplastic origin or reactive response if other features of these cell types are absent. These nucleoli are much smaller than the macro-nucleoli seen in Reed-Sternberg and Hodgkin cells, which are often the size of a red blood cell.

Body Fluid Photographs

CMP-09



(PLEURAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Monocyte/macrophage	2564	72.0	Non-consensus
Macrophage containing abundant small lipid vacuole(s)/droplet(s) (Lipophage)	866	24.3	Non-consensus

The arrowed objects are macrophages, categorized as monocyte/macrophage, as correctly identified by 72.0% of participants. Macrophages are characterized by their large size and abundant light grey-blue cytoplasm. The nucleus is classically round to oval/irregular in contour and may be single or multiple. The cytoplasmic margins often appear irregular due to the presence of pseudopodia. Pseudopodia are cytoplasmic extensions that function in capturing and ingesting extracellular substances including debris, bacteria, and other cells. The presence of cytoplasmic vacuoles with phagocytosed debris is a useful feature to help distinguish macrophages from other cell types. A standard macrophage may have small and large clear vacuoles scattered within the cytoplasm as seen in the arrowed cells. In contrast, a lipophage is characterized by abundant, small and remarkably uniform cytoplasmic vacuoles. Although macrophages may form loose clusters, they lack the molding and intercellular "windows" seen in mesothelial cell groups.

Case Presentation:

This patient is a 58-year-old woman with a history of Hodgkin lymphoma status post radiation and chemotherapy. Pleural fluid sample laboratory findings include: WBC = 262/µL (0.262 × 10E3/µL); RBC = 11,300/µL (11.300 × 10E3/µL). Identify the arrowed object(s) on each image

(PLEURAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Case Discussion: Hodgkin Lymphoma

Classical Hodgkin lymphoma (CHL) is a neoplasm derived from B-lymphocytes. HL is characterized morphologically by large atypical, neoplastic B-cells in a variable background of fibrosis and non-neoplastic inflammatory cells including eosinophils, lymphocytes, neutrophils, histiocytes, and plasma cells. CHL is relatively common and accounts for approximately 20 - 30% of all lymphomas in the US and Europe. The incidence of HL demonstrates a bimodal age distribution with the first peak in individuals between the ages of 15 to 45 years and the second peak over the age of 50 years. Hodgkin lymphoma commonly presents at an early stage of disease with painless, slowly enlarging lymph nodes and symptoms of weight loss, night sweats, and fever. Interestingly, a subset of patients report lymph node pain associated with ingestion of alcoholic beverages.

CHL most often occurs within the lymph nodes of the neck, axilla, mediastinal and inguinal areas as well as the spleen. The bone marrow is rarely involved but is always sampled by a bone marrow biopsy for staging purposes. Involvement of multiple sites outside the lymph nodes, such as the pleural fluid, is associated with a worse prognosis. These extranodal sites are very rarely the initial site of disease and more often represent spread or relapse from involved lymph nodes. Therefore, a new diagnosis of CHL in a body fluid should be made with extreme caution in the absence of a previous lymphoma diagnosis or concurrent lymph node involvement.

CHL is diagnosed in body fluids based on identification of large neoplastic B-cells, which average 40-70 um in diameter and often comprise only a small proportion of total cells within a sample. Therefore, a careful search should be performed. The large neoplastic cells and are referred to as Reed-Sternberg cells (contain multiple nucleoli) or Hodgkin cells (contain a single nucleoli). These cells characteristically contain a macro-nucleolus that is approximately the size of an erythrocyte within each nucleus. In bi-nucleated Reed-Sternberg cells, this creates the characteristic "owl's eye" appearance. The appearance of the cytoplasm is variable and not critical for diagnosis.

The natural history of CHL is characterized by slowly progressive disease with relapses. Fortunately, greater than 85% of patients can be cured with modern treatment. Poor prognostic factors include advanced disease stage, advanced age, bulky mediastinal disease, and extranodal disease at multiple sites. A patient's treatment regime is selected based on disease stage and clinical risk factors. Treatment often includes radiation therapy of the involved lymph nodes and multiagent chemotherapy. New molecular targeted therapies such as brentuximab vedotin have also been introduced for patients with relapsed CHL. Overall; CHL is a common, often curable B-cell lymphoma that is occasionally encountered in body fluid samples.

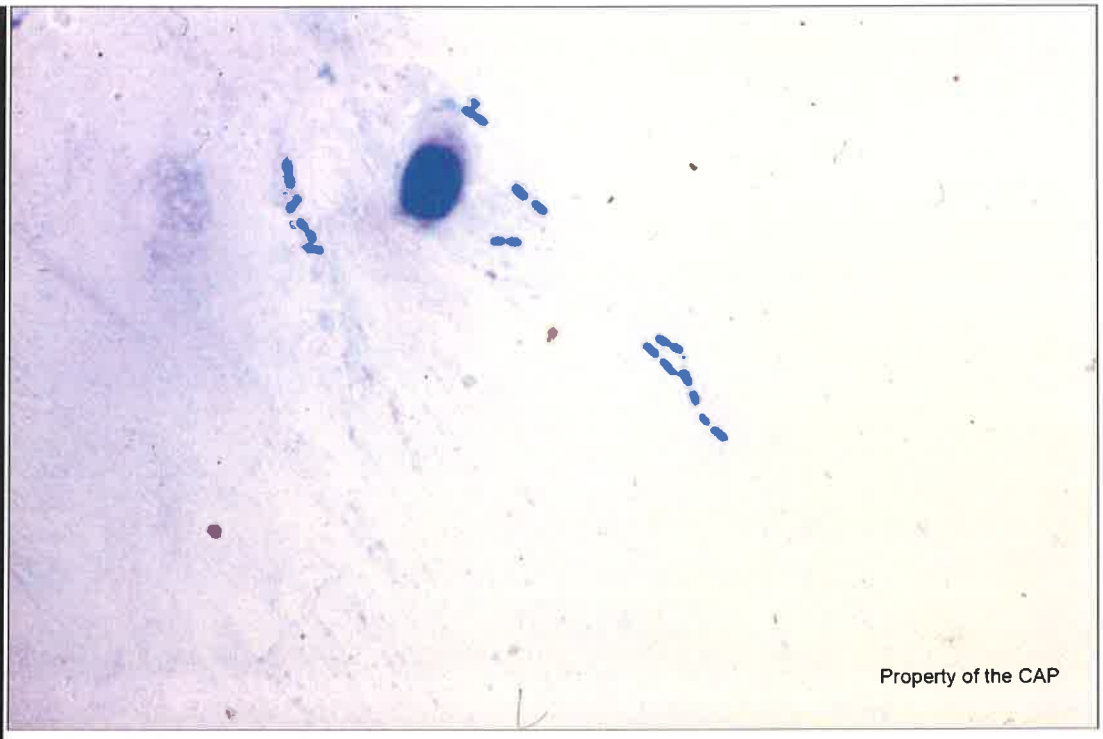
Amy Thommasen, MD
Hematology and Clinical Microscopy Resource Committee

References:

1. Kjeldsberg CR, Perkins SL, eds. *Practical Diagnosis of Hematologic Disorders*. 5th ed. Singapore: American Society for Clinical Pathology. Chicago, IL; 2010.
2. Jaffe ES, Arber DA, Campo E, Harris NL, and Quintanilla-Martinez L, eds. *Hematopathology*. 2nd ed. Philadelphia, PA: Elsevier; 2017.

CMMP – Clinical Microscopy Miscellaneous Photographs

CMMP-22



(NASAL, WRIGHT-GIEMSA) High power magnification

Identification	CMMP Participants No.	%	Performance Evaluation
Eosinophils are absent	2000	99.5	Good

This nasal smear is negative for eosinophils. Eosinophils typically have a bilobed nucleus and with Wright-Giemsa stain eosinophilic granules are red due to their staining with eosin. Nasal eosinophils are seen in patients with clinical allergic rhinitis. In nonallergic causes of nasal discharge, either acellular mucus or neutrophils will be present on the nasal smear. Nasal smears for eosinophils are prepared by having the patient blow his/her nose in a nonabsorbent material (wax paper, plastic wrap). A swab is then used make a thin smear of mucus on a glass slide, which is then air dried. Staining is usually performed with the commonly available Wright-Giemsa stain, although a Hansel stain may be used in some laboratories; the eosinophilic granules are intensely red with Hansel stain.

CMMP – Urine Sediment Color Photographs

Case History USP-01 and USP-03

This urine specimen is from a 1-year-old boy with low grade fever, fussiness, and poor eating and drinking habits for the past week. Laboratory data include: specific gravity = 1.030; pH = 5.0; ketones, glucose, protein, leukocyte esterase, protein, and nitrite = positive.

USP-01

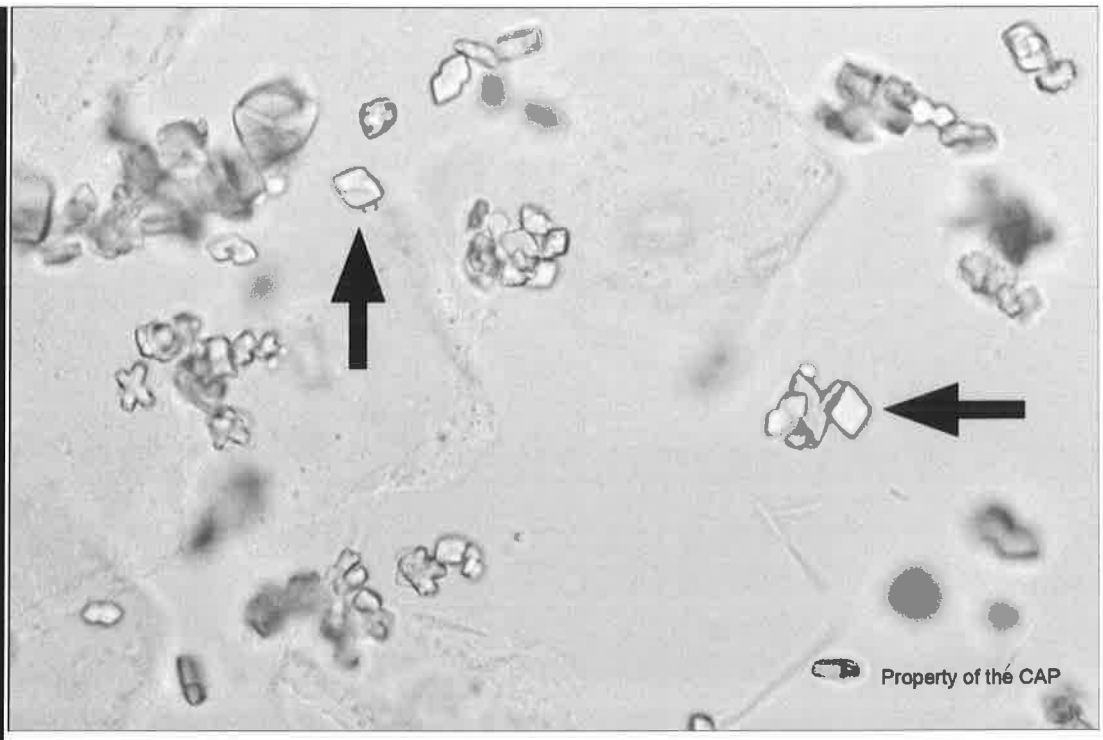
(URINE, UNSTAINED, HIGH POWER)

Identification	CMMP Participants No.	%	Performance Evaluation
Yeast/fungi	3900	99.0	Good

The arrowed objects are yeast/fungi as correctly identified by 99.0% of participants. *Candida albicans* is the most commonly encountered fungal organism. It presents as both thick-walled ovoid yeast 5 - 7 µm in diameter, as well as pseudohyphae with branching and terminal budding.

CMMP – Urine Sediment Color Photographs

USP-02



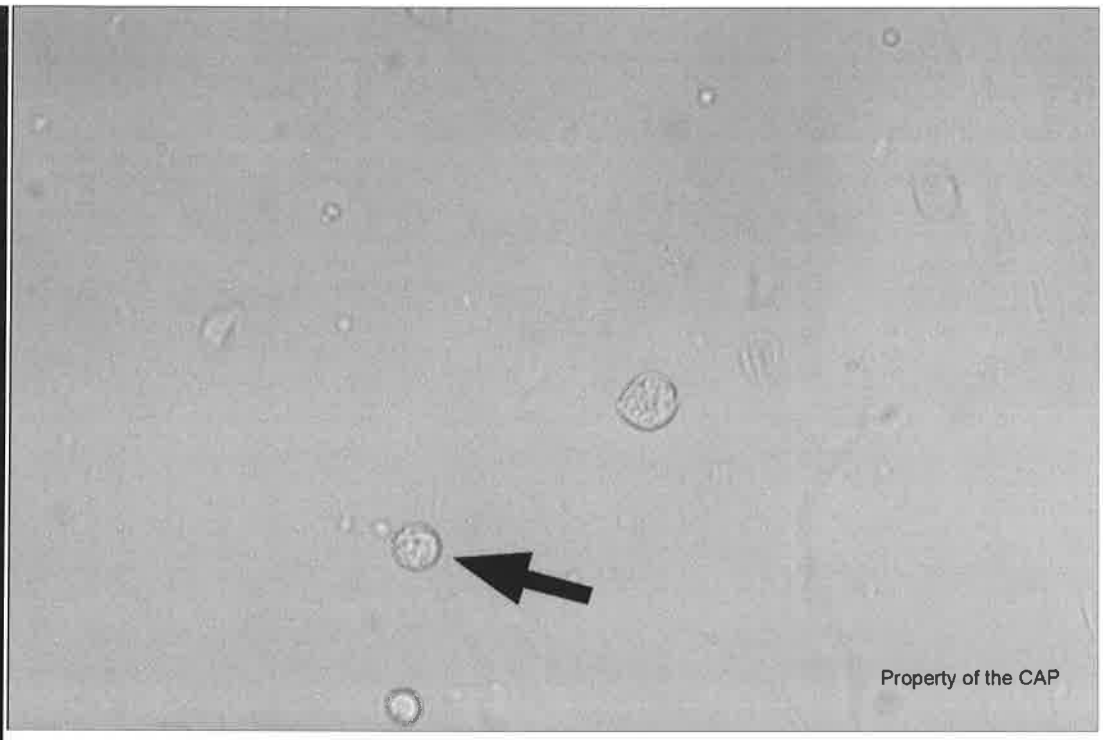
(URINE, UNSTAINED, HIGH POWER)

Identification	CMMP Participants No.	%	Performance Evaluation
Uric acid crystal	3781	95.9	Good

The arrowed objects are uric acid crystals as correctly identified by 95.9% of participants. Uric acid crystals are seen in urines with low pH. They present in a variety of shapes; those shown here are four-sided and flat, one of the more common presentations. Other less common morphologies include lemon-shaped forms, needles, wedges, and stars. The crystals are usually yellow to brown in color and birefringent.

CMMP – Urine Sediment Color Photographs

USP-03



(URINE, UNSTAINED, HIGH POWER)

Identification	CMMP Participants No.	%	Performance Evaluation
Leukocyte (neutrophil, eosinophil, lymphocyte)	3893	98.8	Good

The arrowed object is a leukocyte as correctly identified by 98.8% of participants. Increased leukocytes can be seen in the urine in most urinary tract disorders, and are usually neutrophils. While a few neutrophils (1 - 5 per hpf) can be seen in healthy persons, higher numbers are usually associated with infection. In unstained preparations, neutrophils are granular cells 10 - 12 µm in diameter. If the sample is relatively fresh nuclear segmentation can be discerned, however with cellular degeneration the segments may fuse and granules may also be lost. Other leukocytes present in urine can be difficult to classify in unstained preparations, although eosinophils and monocytes will usually be slightly larger than neutrophils.