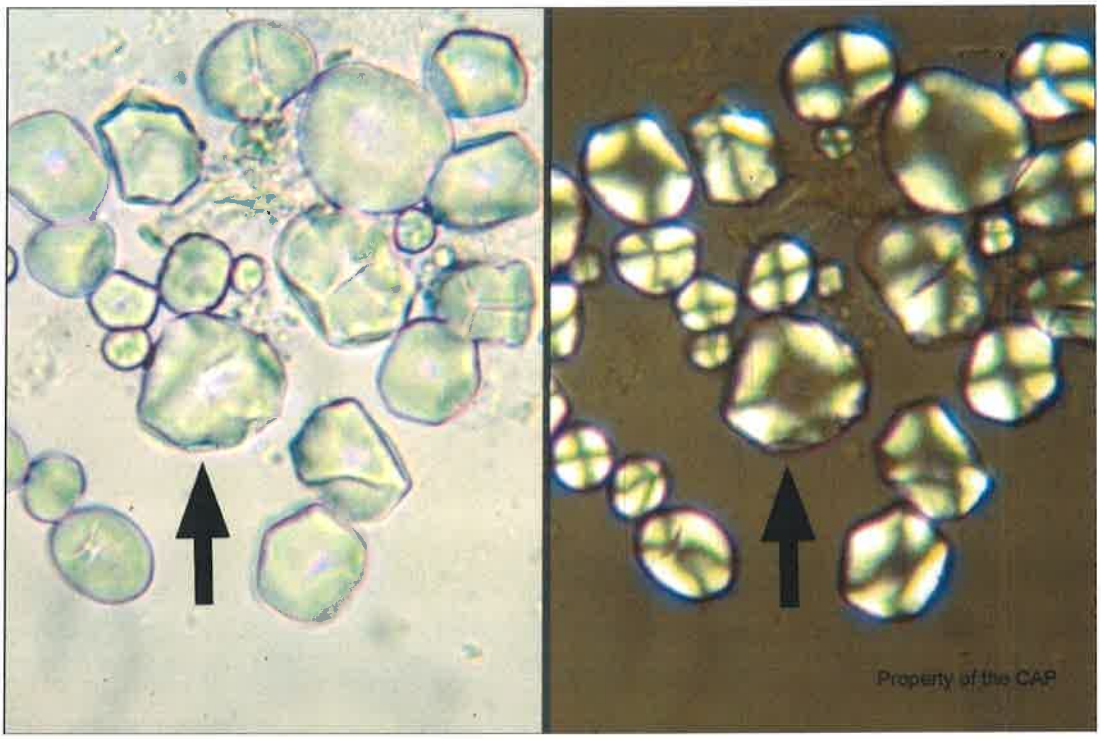
Urine Sediment Photographs

Case History CMP-13 through CMP-15

This urine sample is obtained from a 43-year-old woman. Laboratory data includes: specific gravity = 1.012; pH = 7.0; blood, protein, glucose, ketones, nitrite, leukocyte esterase, bilirubin, and urobilinogen = negative. The crystals are soluble in dilute acetic acid.

CMP-13



(URINE, UNSTAINED, HIGH POWER)

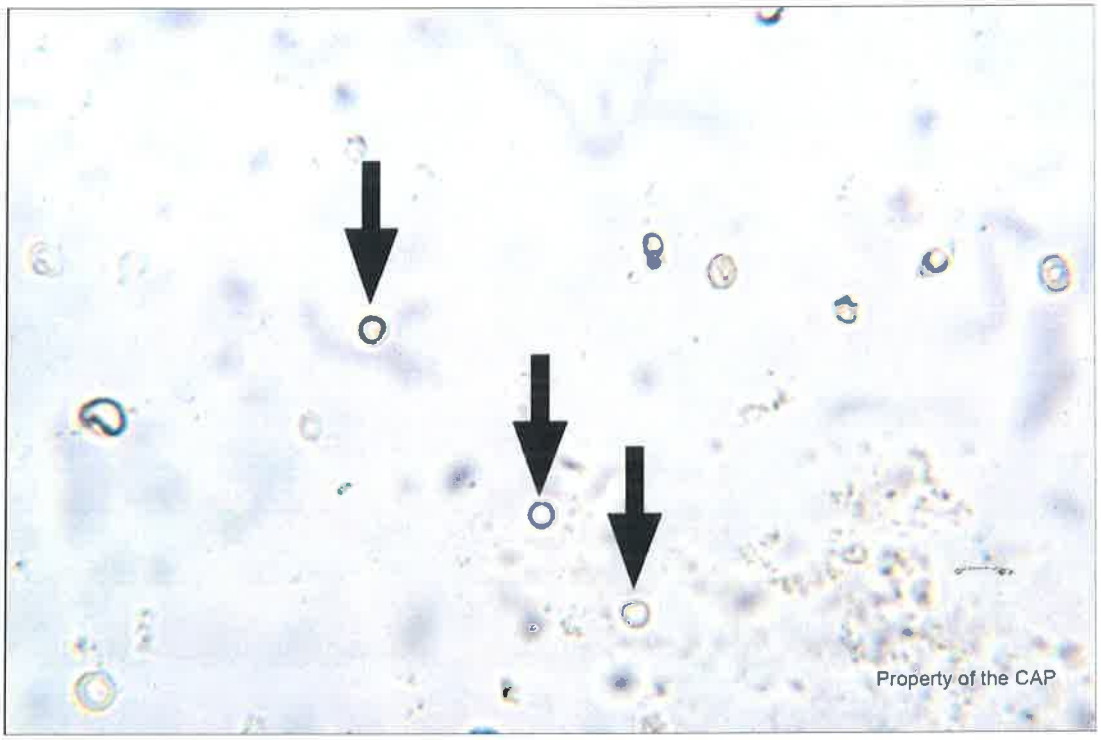
Identification	CMP Participants No.	%	Performance Evaluation
Starch granules	6032	96.3	Good

The arrowed objects are starch granules, as correctly identified by 96.3% of participants. Starch granules have a slightly irregular wall, irregular round or oval shapes, and a central slit-like structure. Starch granules are birefringent, and show a Maltese cross pattern under polarized light. The presence of starch in urine is due to contamination, most often by talcum or glove powder.

Starch crystals are rarely confused with other objects due to the central slit-like structure. Pollen differs in that it is usually larger with a thick wall.

Urine Sediment Photographs

CMP-14



(URINE, UNSTAINED, HIGH POWER)

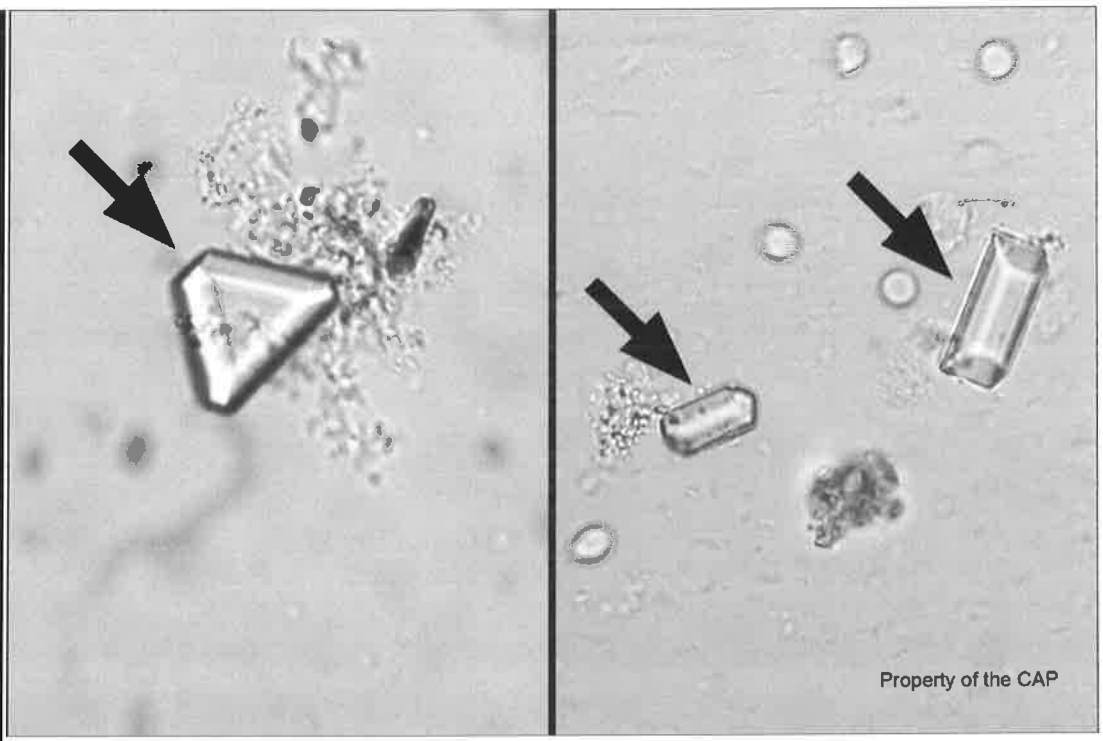
Identification	CMP Participants No.	%	Performance Evaluation
Erythrocytes	5594	89.3	Good

The arrowed objects are erythrocytes, as correctly identified by 89.3% of participants. Erythrocytes (RBCs) in urine are uniform round or oval biconcave discs. Because they contain variable amounts of hemoglobin they may occasionally be colorless or pale yellow-orange. Erythrocytes may be found in normal urine in small numbers, less than 5 per high power field. Erythrocytes are increased in urinary tract infections, urinary tract stone disease, glomerulonephritis, trauma, systemic anticoagulation and with vaginal contamination.

Erythrocytes in urine may be mistaken for yeast, pollen, starch, air bubbles, fat droplets or monohydrate calcium oxalate crystals. Erythrocytes lack the refractive membranes and budding seen in yeast and the central slit-like structure seen in starch. Pollen grains are nearly three times larger than erythrocytes, with a thick wall. Erythrocytes are uniform and may be colored due to hemoglobin. These features may be used to differentiate erythrocytes from fat droplets and air bubbles. Monohydrate calcium oxalate crystals are refractive, oval, round or dumbbell-shaped and usually accompanied by the more common dihydrate forms.

Urine Sediment Photographs

CMP-15



(URINE, UNSTAINED, HIGH POWER)

Identification	CMP Participants No.	%	Performance Evaluation
Ammonium magnesium (triple) phosphate crystals	6178	98.7	Good

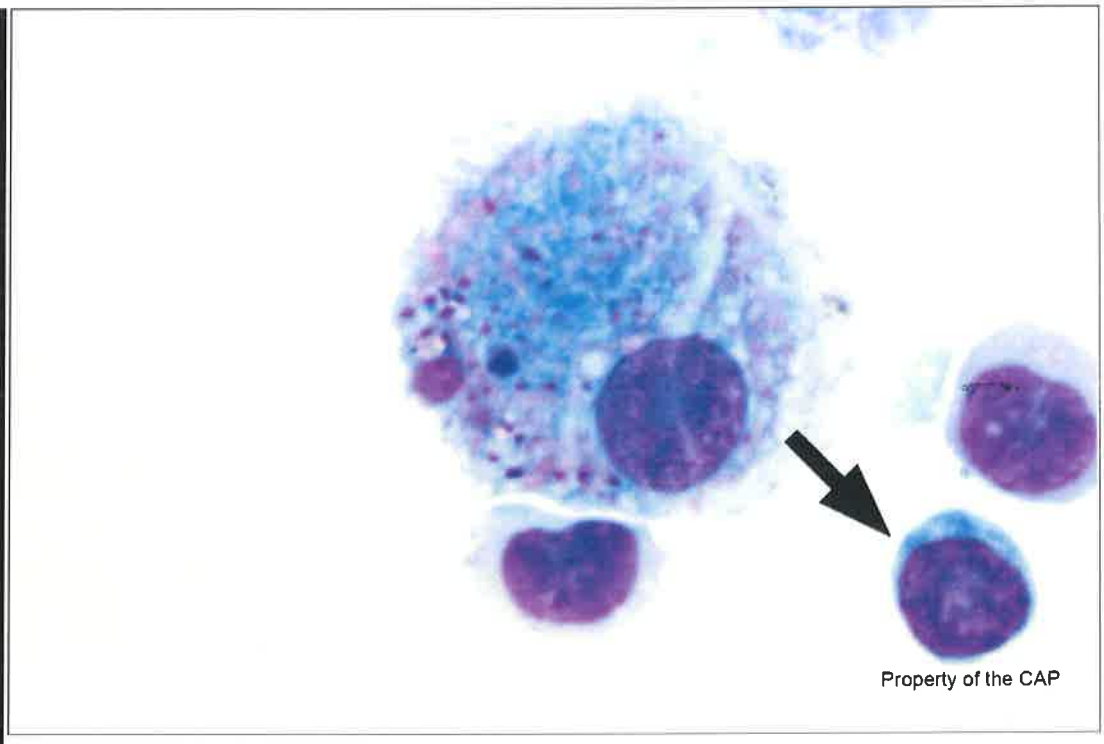
The arrowed object(s) are ammonium magnesium (triple) phosphate crystals, as correctly identified by 98.7% of participants. The appearance of ammonium magnesium phosphate crystals, or triple phosphate crystals, is commonly compared to "coffin lids." Triple phosphate crystals are larger than calcium oxalate crystals, colorless, and found at neutral or alkaline pH. As they dissolve they may have a four-armed feathery appearance. They are found in normal urine.

Body Fluid Photographs

Case History CMP-16 through CMP-18

This patient is a 53-year-old man with a history of hepatitis C cirrhosis, post liver transplant, who was admitted with worsening hepatic encephalopathy and abdominal distention. Peritoneal fluid was removed due to severe ascites. Laboratory data shows: Total Nucleated Cells = 90/µL (0.090 x 10E3/µL); RBC count = 64/ µL (0.064 x 10E3/µL).

CMP-16



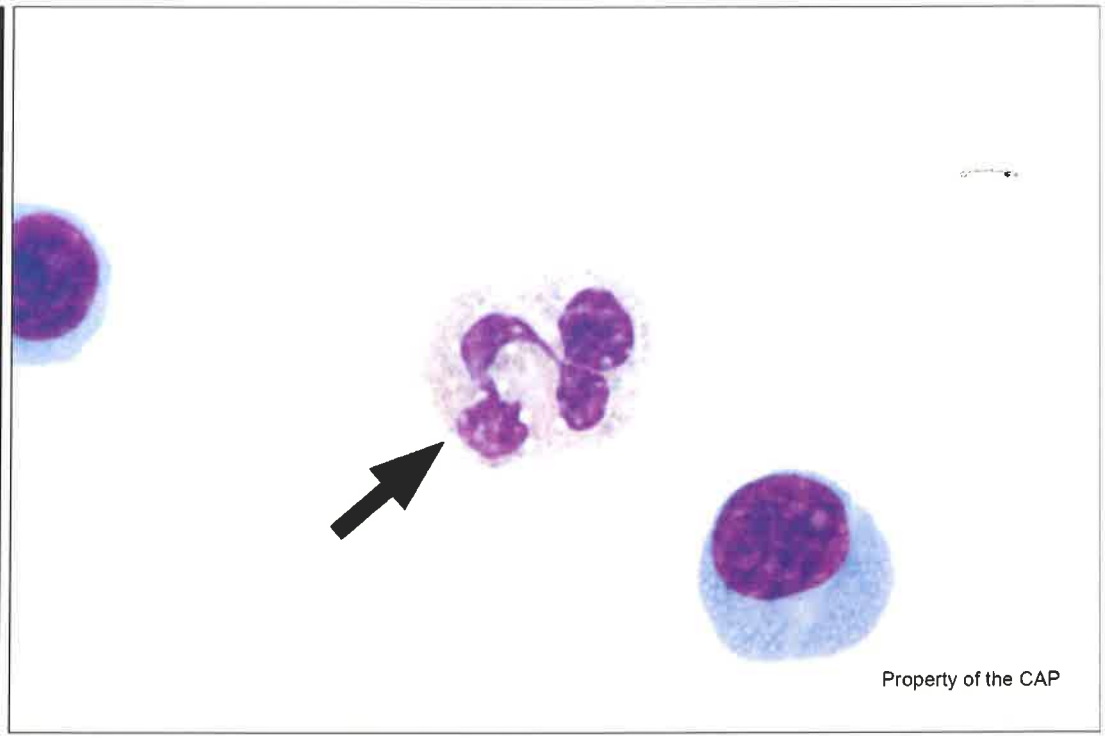
(PERITONEAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Lymphocyte	3845	99.1	Good

The arrowed cell is a lymphocyte, as correctly identified by 99.1% of participants. The cytologic features of lymphocytes in body fluids prepared by cytocentrifugation may differ from those in blood smears. Changes induced by cytocentrifugation may include cytoplasmic spreading, nuclear convolutions, and nucleolar prominence. The mature or quiescent lymphocyte appears slightly larger than its counterpart on blood smears, often with more abundant cytoplasm, but is usually smaller than neutrophils and monocytes. Due to the high speed used in cytocentrifugation, a small nucleolus may be seen, and this should not be interpreted as indicative of lymphoma or immaturity. A few azurophilic granules may be noted in the lymphocytes on slides prepared by cytocentrifugation and do not denote abnormality in isolation.

Body Fluid Photographs

CMP-17



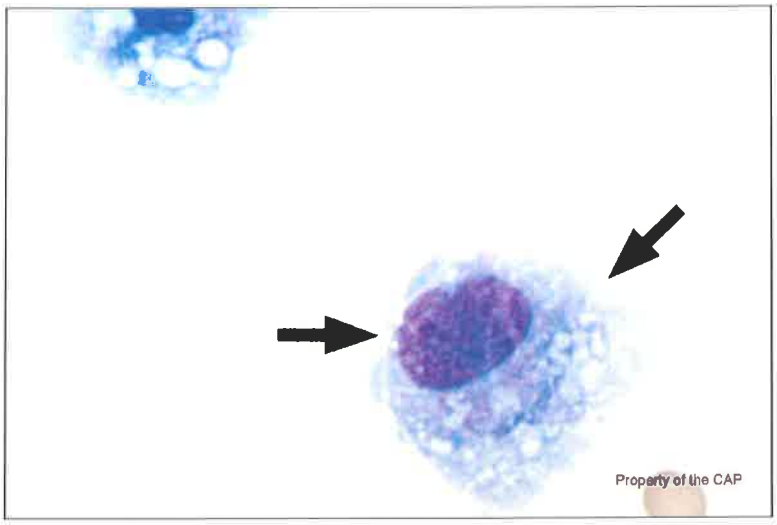
(PERITONEAL, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Neutrophil, segmented or band	3815	98.3	Good

The arrowed cell is a neutrophil, segmented or band, as correctly identified by 98.3% of participants. Usually the segmented or band neutrophil is easily recognized. Often, the nuclear lobes appear eccentric in cytocentrifuge preparations. Neutrophils in body fluids can show morphologic change due to autolysis, including nuclear pyknosis and fragmentation, making recognition of cell type difficult. In particular, these autolytic neutrophils can be mistakenly identified as nucleated red blood cells; however, persistence of a few azurophilic granules in the cytoplasm provides a clue to the neutrophilic origin.

Body Fluid Photographs

CMP-18



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

Identification	CMP Referees No.	CMP Referees %	CMP Participants No.	CMP Participants %	Performance Evaluation
Monocyte/macrophage	43	72.9	2716	70.0	Non-consensus
Macrophage containing abundant uniform small lipid vacuoles/droplets (Lipophage)	7	11.9	772	19.9	
Mesothelial cell	8	13.6	306	7.9	
Plasma cell, normal/abnormal	-	-	21	0.5	
Immature or abnormal cell, would refer information for identification	1	1.7	23	0.6	

The arrowed cell is a monocyte/macrophage, as correctly identified by 70.0% of participants. Monocytes are bone marrow-derived cells that circulate in the blood. Macrophages arise from bone marrow-derived cells that migrate into tissues and evolve morphologically. Monocyte/macrophage morphology in fluids is quite variable, ranging from the typical monocyte of the peripheral blood to a vacuolated, activated stage with the morphology of a typical macrophage. Monocytes are usually large (12 to 20 µm) with abundant blue-gray cytoplasm and often contain sparse azurophilic granules. The nucleus is round to oval and may show indentation, giving it a kidney bean or horseshoe shape. The chromatin is lacy and small nucleoli may be apparent. Macrophages are larger cells (15 to 80 µm) with abundant cytoplasm showing evidence of active phagocytosis. This includes ingested material such as other blood cells or bacteria, hemosiderin, fungi, and/or remnants of digested materials as well as cytoplasmic vacuoles post ingestion. One or more round to oval nuclei are present and occasionally prominent nucleoli may be seen. Macrophages can at times be difficult to differentiate from mesothelial cells. Mesothelial cells are usually larger than monocytes/macrophages and usually show a biphasic staining cytoplasm with surface microvilli. The lack of biphasic staining helps exclude a mesothelial cell in the arrowed image. 19.9% of participants identified the arrowed cell as a macrophage containing abundant uniform small lipid vacuoles/droplets (ie, a lipophage). The lipophage must contain uniform, small lipid vacuoles, as stated in the description, that completely fill the cytoplasm. These fat-filled inclusions may originate from extracellular fatty material or from the membranes of ingested cells. Although the arrowed cell contains some cytoplasmic inclusions, they do not completely fill the cytoplasm, and they are not uniform in size.

Case Presentation:

This patient is a 53-year-old man with a history of hepatitis C cirrhosis, post liver transplant, who was admitted with worsening hepatic encephalopathy and abdominal distention. Peritoneal fluid was removed due to severe ascites. Laboratory data shows: Total Nucleated Cells = 90/µL (0.090 x 10E3/µL); RBC count = 64/ µL (0.064 x 10E3/µL).

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

Case Discussion: Hepatitis C, Cirrhosis, and Ascites

Hepatitis C was initially described in the 1970s and termed as non-A, non-B hepatitis. In 1989, the existence of hepatitis C virus (HCV) was proven and reported. HCV is a small, enveloped, single-stranded, positive-sense RNA virus. It is a member of the genus Hepacivirus in the family Flaviviridae. 3% of patients worldwide are seropositive for HCV antibodies, accounting for 170 million cases worldwide; 2.4 million people in the United States alone are infected by this virus.

There are seven major genotypes of HCV; in the United States, 70% of HCV cases are caused by genotype 1, 20% by genotype 2, and about 1% by each of the other genotypes. After primary diagnosis, genotyping provides important prognostic and predictive information for infected patients. The more common modes of transmission have historically been blood transfusions and needle-stick injuries. However, transmission due to blood transfusions has drastically dropped since the 1980s after discovery of the virus and subsequent implementation of donor screening. Currently, an estimated 35% of all cases in the U.S. are contracted through IV drug use, and are likely increasing due to the current opioid epidemic.

Acute infection is frequently subclinical and fulminant hepatitis is rare. Untreated, upwards of 85% of cases progress to chronic hepatitis, which is defined by persistent viral replication 6 months after infection, with 20% of cases subsequently developing cirrhosis. This progression is also associated with increased risk of hepatocellular carcinoma which is more frequently seen in older patients, males, and those with concordant alcohol abuse. Recently, medications to treat HCV have been developed with high efficacy and limited side effects. Unfortunately, cirrhosis owing to hepatitis C still remains a leading indication for liver transplantation, though the infection frequently recurs after transplantation.

Ascites is the most common complication of patients with cirrhosis, and likely develops due to vasodilation secondary to increased hepatic resistance and resulting disturbances of the normal physiology of electrolyte and fluid homeostasis. Patients may undergo paracentesis, whereby fluid is removed through the abdomen under sterile technique, for symptomatic relief and/or for diagnostic purposes. These specimens typically yield transudate fluid with a predominance of lymphocytes and monocytes/macrophages, as well as mesothelial cells. Even in patients with concordant hepatocellular carcinoma, the diagnostic yield is low as peritoneal spread of this carcinoma is uncommon.

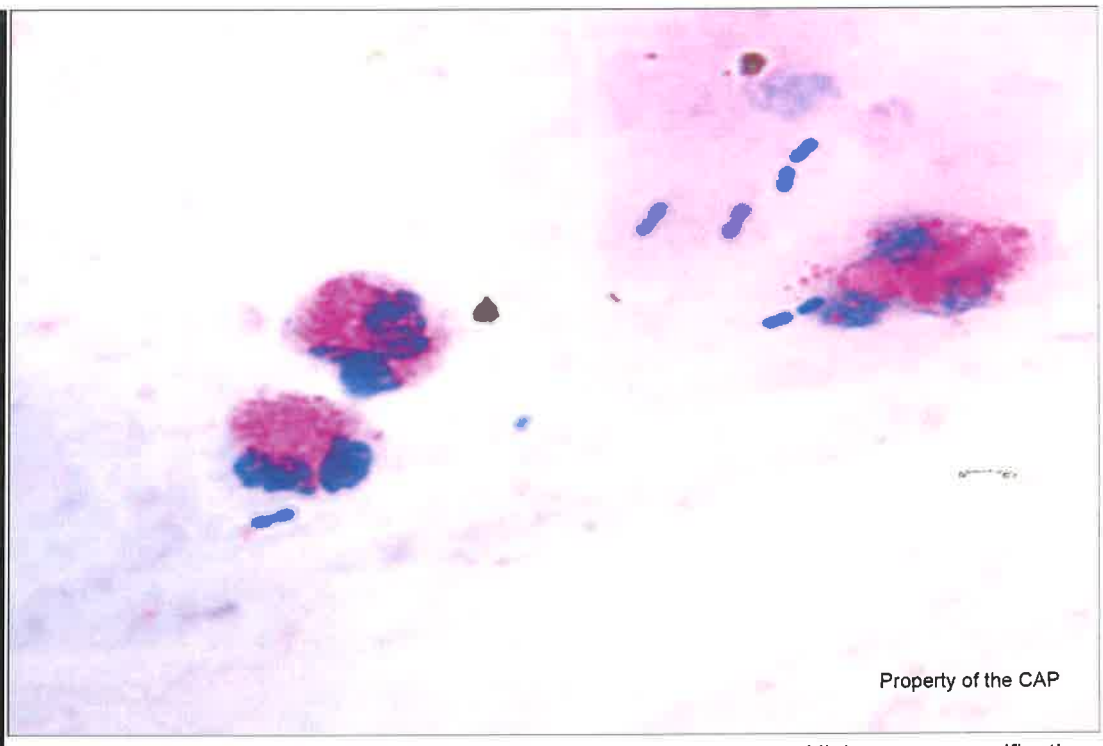
Natasha M. Savage, MD, FCAP
Hematology and Clinical Microscopy Committee

References:

1.Choo QL, Kuo G, Weiner AJ, Overby LR, Bradley DW, Houghton M. Isolation of a cDNA clone derived from a blood-borne non-A, non-B viral hepatitis genome. *Science*. 1989;244(4902):359–362.
2. Gines P, Cardenas A, Arroyo V, Rodes J. Management of cirrhosis and ascites. *N Engl J Med*. 2005;350:1646–1654.

CMMP – Clinical Microscopy Miscellaneous Photographs

CMMP-32



(NASAL, WRIGHT-GIEMSA) High power magnification

Identification	CMMP Participants No.	%	Performance Evaluation
Eosinophils are present	2074	99.5	Good

This photomicrograph demonstrates a Wright-Giemsa stained nasal smear. Two eosinophils with bright orange-red spherical granules are seen. The finding of nasal eosinophils is supportive of the diagnosis of allergic rhinitis. These cells have nuclei with two lobes separated by a thin filament. Non-allergic causes of nasal discharge will typically be acellular or show a predominance of neutrophils rather than eosinophils.

CMMP – Urine Sediment Color Photographs

Case History USP-04 through USP-06

This urine sample is from a 75-year-old woman from a nursing home, who developed urinary incontinence. Laboratory data include: specific gravity = 1.026; pH = 7.5; blood, protein, glucose, ketones, bilirubin, and urobilinogen = negative; nitrite and leukocyte esterase = positive. The crystals are soluble in dilute acetic acid.

USP-04

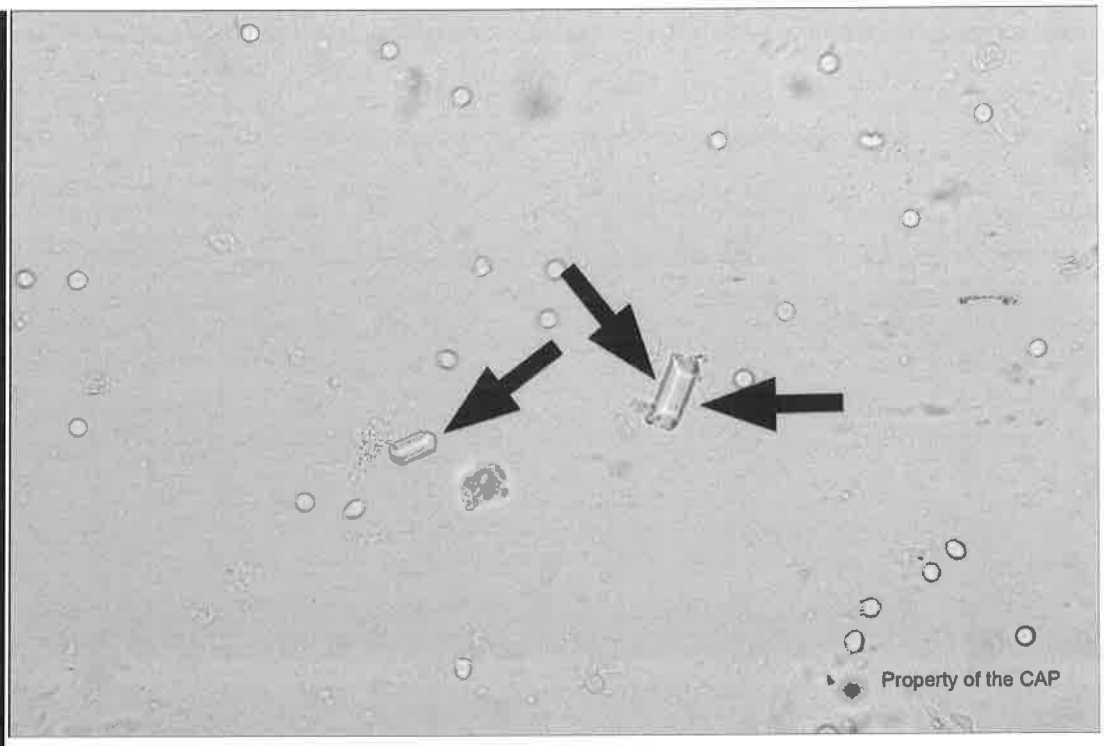
(URINE, UNSTAINED, HIGH POWER) High power magnification

Identification	CMMP Participants No.	%	Performance Evaluation
Bacteria	4098	98.1	Good

The arrowed objects are bacteria, as correctly identified by 98.1% of participants. Bacteria in urine can be either round (cocci) or rod-shaped (bacilli). They can be present singly or in clusters, pairs, or chains. Bacteria are small in comparison to leukocytes and other cells, and generally have a uniform size and shape. In patients being treated with antibiotics, the bacteria can take abnormally elongated shapes.

CMMP – Urine Sediment Color Photographs

USP-05



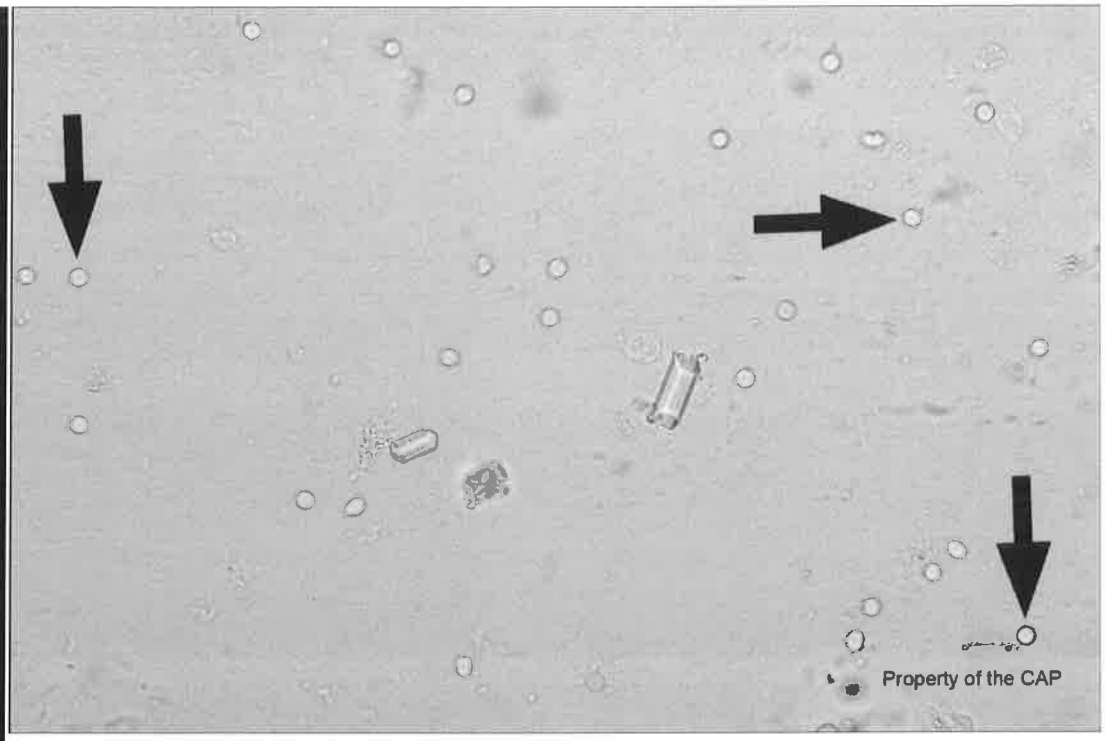
(URINE, UNSTAINED, HIGH POWER)

Identification	CMMP Participants No.	%	Performance Evaluation
Ammonium magnesium (triple) phosphate crystals	4132	98.9	Good

The arrowed objects are ammonium magnesium (triple) phosphate crystals, as correctly identified by 98.9% of participants. These crystals are typically seen in urine of neutral to alkaline pH. They are colorless and large, which a characteristic "coffin-lid" appearance, although they may take on a feathery-appearance as they dissolve. Ammonium magnesium phosphate crystals are birefringent and may be seen in random specimens, or in association with struvite nephrolithiasis.

CMMP – Urine Sediment Color Photographs

USP-06



(URINE, UNSTAINED, HIGH POWER)

Identification	CMMP Participants No.	%	Performance Evaluation
Erythrocytes	3578	85.7	Good

The arrowed objects are erythrocytes, as correctly identified by 85.7% of participants. Erythrocytes, or red blood cells, are round with no nucleus. They are 7 to 8 µm in diameter and appear as pale yellow-orange discs in unstained specimens; however, if the sample is old or hypotonic they may be colorless and fainter. In hypertonic urine red blood cells may become crenated. Small numbers of erythrocytes may be found in the urine sediment of otherwise normal patients. Larger numbers may indicate disease anywhere in the kidney or urinary tract. Hematuria can also be seen in patients with bleeding disorders or iatrogenic anticoagulation or trauma. Contamination of the urine by menstrual blood frequently causes falsely positive test results.