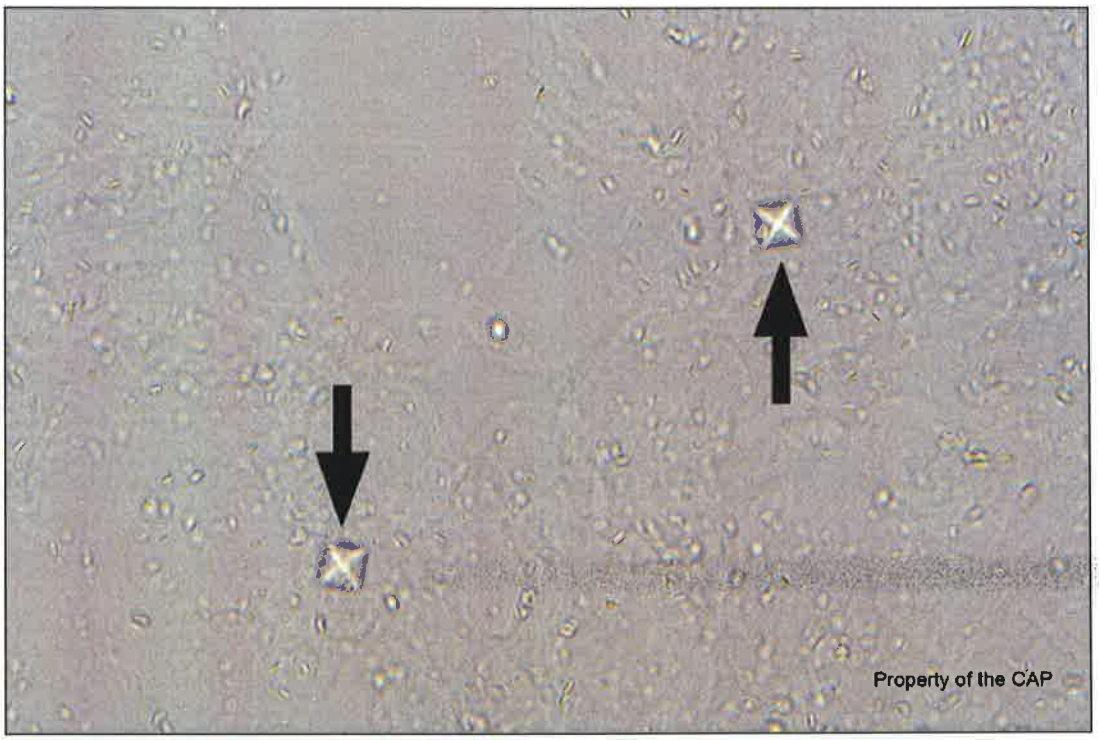
Urine Sediment Photographs

Case History CMP-04 through CMP-07

This urine sample is obtained from a 56-year-old man presenting with cirrhosis of the liver. Laboratory data include: specific gravity = 1.035; pH = 6.0; blood, leukocyte esterase, nitrite, bilirubin, and urobilinogen = positive; glucose, ketones, and protein = negative.

CMP-04



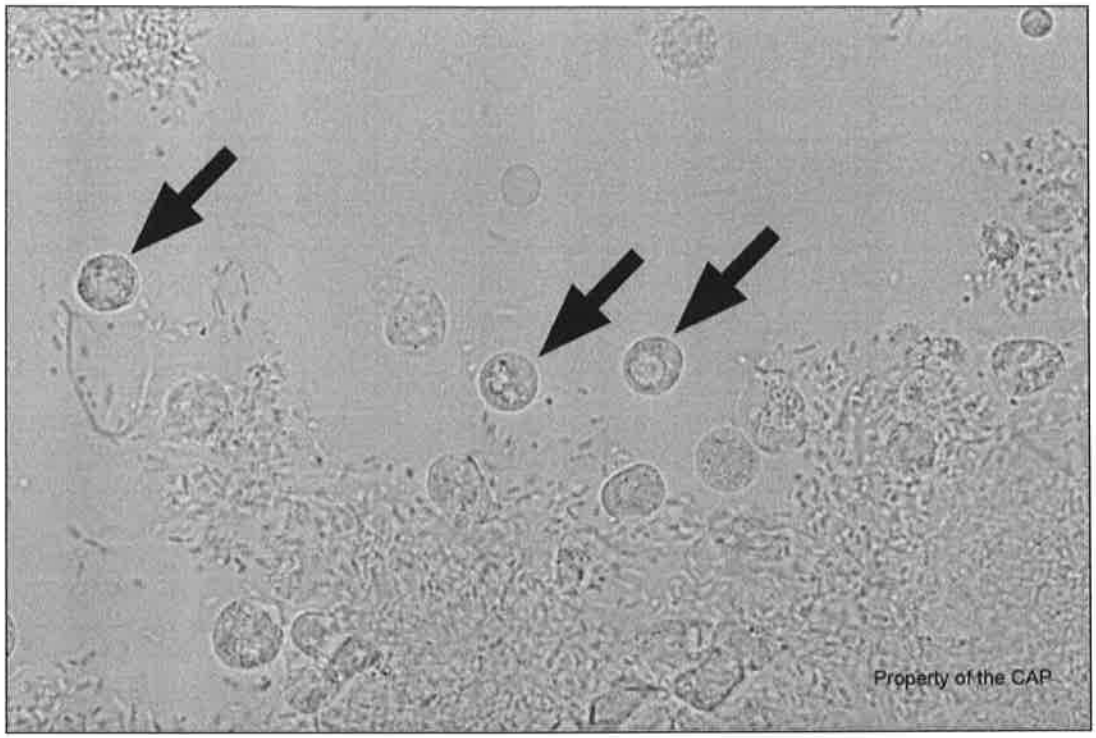
(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Calcium oxalate crystals	6028	99.6	Good

The arrowed objects are calcium oxalate crystals, as correctly identified by 99.6% of participants. Calcium oxalate crystals occur most often in acid urine, usually as the dihydrate form. The small clear octahedrons resemble stars or envelopes. The crystals vary in size from 3-12 microns. The rarer monohydrate forms are oval, elliptical or dumbbell-shaped. All calcium oxalate crystals are birefringent. Certain foods (asparagus, tomatoes, oranges, carbonated beverages, spinach) contain large amounts of oxalic acid and lead to calcium oxalate formation in the urine. The crystals are a most often a normal finding. Disease states in which calcium oxalate crystals can be seen include kidney stones and ethylene glycol poisoning.

Urine Sediment Photographs

CMP-05



(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Leukocytes (neutrophil, eosinophil, lymphocyte)	5930	98.0	Good

The arrowed objects are leukocytes, as correctly identified by 98.0% of participants. The most common leukocyte in urine is the neutrophil. Neutrophils begin to degenerate quickly in voided urine and lose nuclear detail within two to three hours at room temperature. Neutrophils normally measure 10-12 microns, or about twice the size of a red blood cell. However, it is common for neutrophils to swell in dilute urine, sometimes reaching 20-30 microns in diameter. Neutrophils also shrink in concentrated urine. Small numbers of leukocytes in urine are normal, with increased numbers indicating infection or inflammation of the kidneys such as glomerulonephritis.

Urine Sediment Photographs

CMP-06

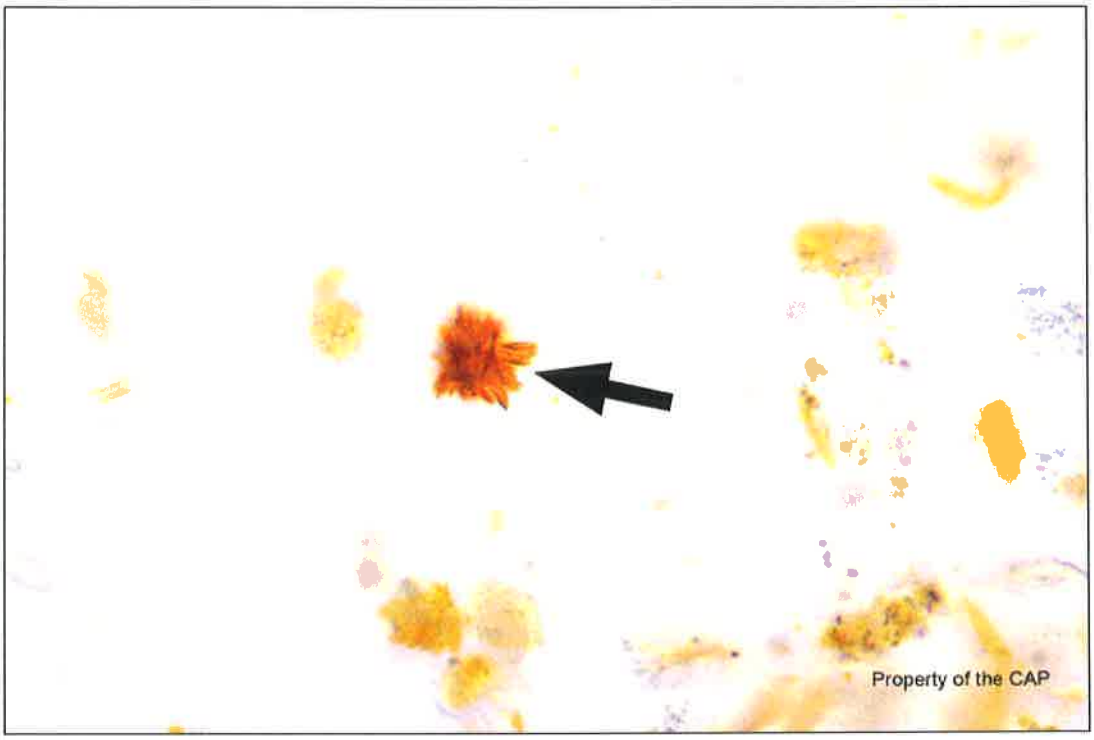
(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Leucine crystals	5490	90.8	Good

The arrowed object is a leucine crystal as correctly identified by 90.8% of participants. Leucine crystals are found in acid urine and are brown spherical crystals with striations radiating from a central core. They are highly refractive, forming a pseudo-Maltese cross pattern with polarized light. They are a rare but significant abnormal finding, being associated with severe liver disease and a hereditary amino acid metabolism disorder (maple syrup urine disease).

Urine Sediment Photographs

CMP-07



(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Bilirubin crystal	5628	93.1	Good

The arrowed object is a bilirubin crystal, as correctly identified by 93.1% of participants. Bilirubin crystals are found in acid urine and form small needles, tiny spheres, granules and cubes. Bilirubin crystals often form clumps and are red-brown to yellow. Bilirubin crystals are found in patients with bile duct obstruction or severe liver disease but are uncommon findings. The urine will test positive for bile.

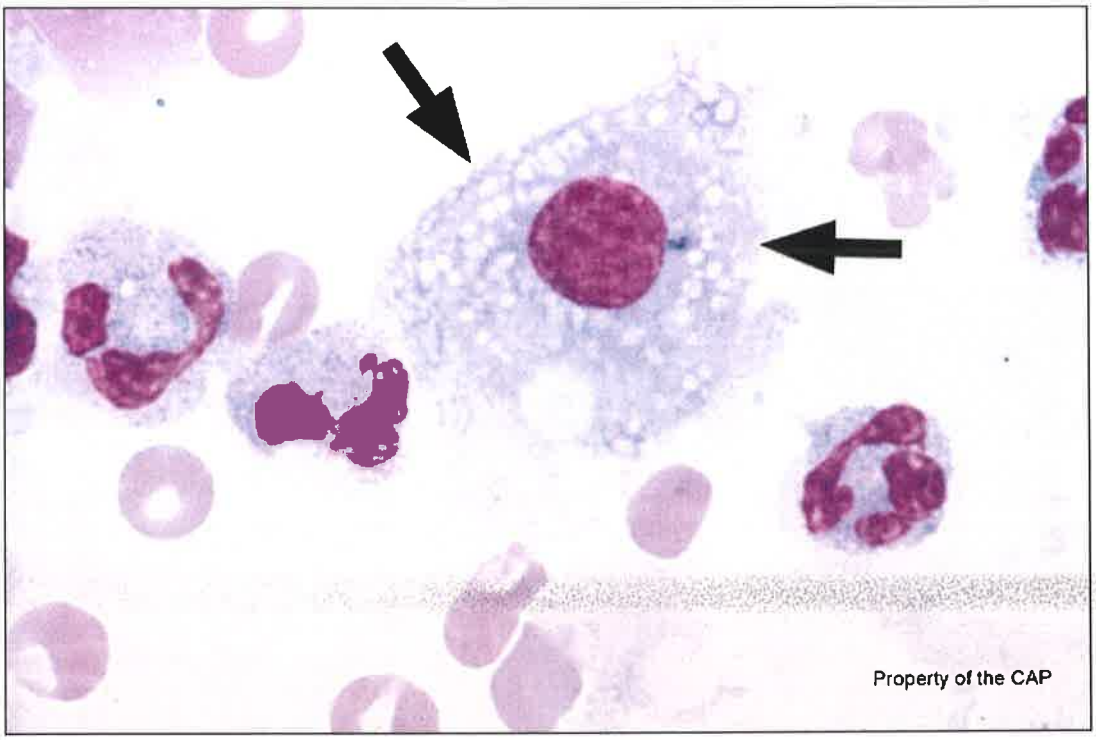
Roberta L. Zimmerman, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

Body Fluid Photographs

Case History CMP-08 through CMP-13

The patient is a 51-year-old man whose primary complaint is shortness of breath. Chest x-ray reveals the presence of pleural effusion. Pleural fluid sample laboratory findings include: WBC = 23,500/µL (23.500 × 10^3/µL); RBC = 71,500/µL (71.500 × 10^3/µL).

CMP-08



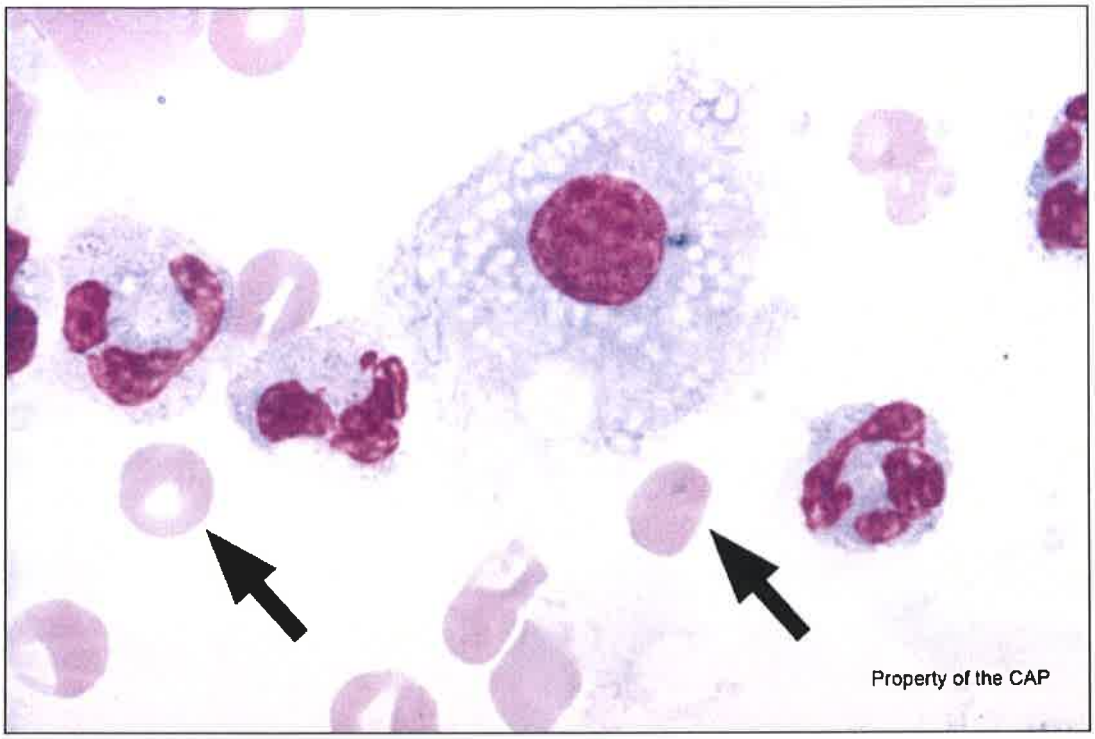
(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Macrophage containing abundant small lipid vacuoles/droplets (Lipophage)	2193	65.8	Educational
Monocyte/macrophage	661	19.8	Educational
Macrophage containing hemosiderin (Siderophage)	206	6.2	Educational
Neutrophil/macrophage with phagocytized bacteria	114	3.4	Educational

The arrowed object is a macrophage/lipophage, as correctly identified by 65.8% of participants. This cell is a specific type of macrophage (see CMP-13 for general description of macrophage) with abundant uniform small lipid-laden vacuoles that fill the cytoplasm completely. The lipid accumulation is usually due to phagocytosis of either extracellular material or cellular membranes from cells undergoing destruction. Nuclei are typically round to oval with inconspicuous nucleoli.

Body Fluid Photographs

CMP-09



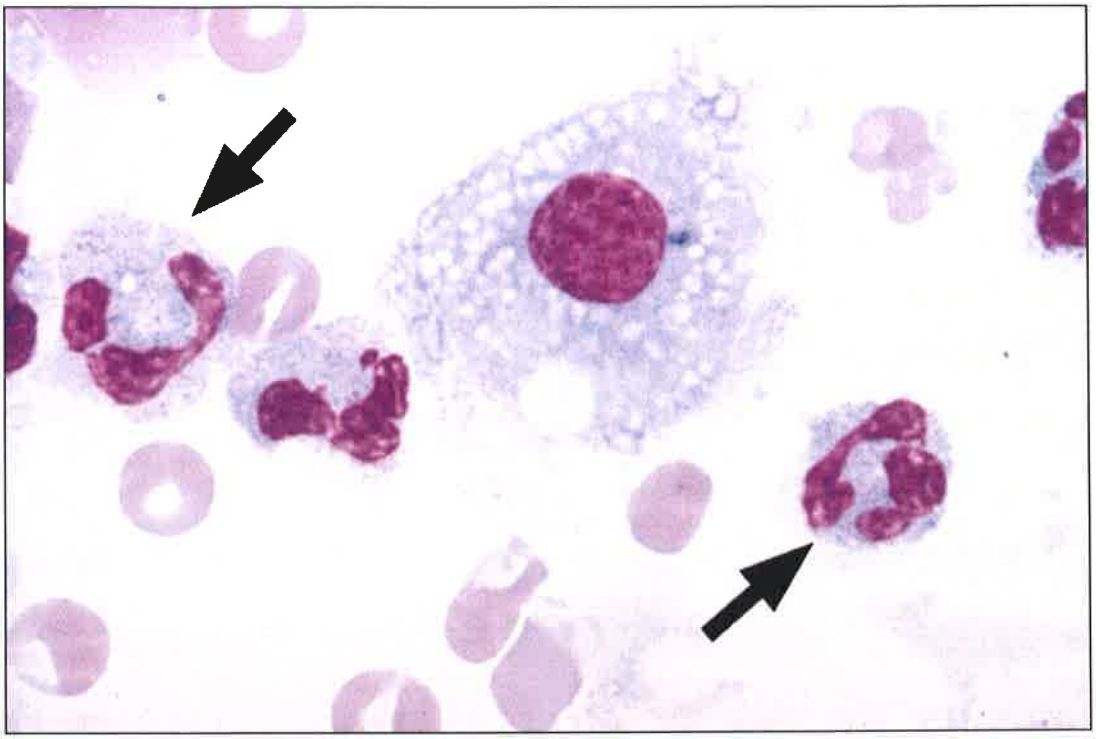
(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Erythrocytes	3336	99.9	Good

The arrowed objects are erythrocytes or red blood cells, as correctly identified by 99.9% of participants. These biconcave disc-shaped cells are enucleate, measure approximately 7µm in diameter, and contain an area of central pallor that occupies one third of the cell width. Erythrocytes primarily function to transport oxygen via hemoglobin and stain pink to red with Wright-Giemsa stain. Identification of large numbers of erythrocytes in a body fluid raises the suspicion for clinical hemorrhage.

Body Fluid Photographs

CMP-10



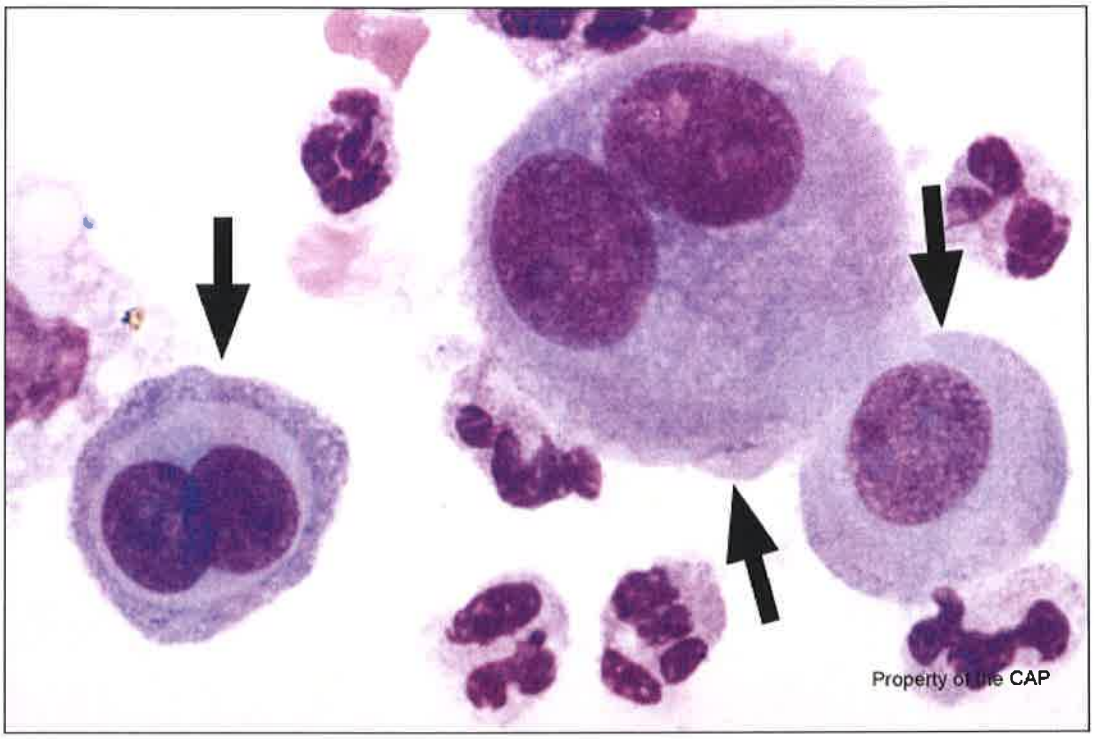
(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Neutrophil, segmented or band	3304	98.9	Good

The arrowed objects are neutrophils, as correctly identified by 98.9% of participants. Segmented neutrophils are mature granulocytes and typically constitute the predominant type of white blood cell in adult blood. Neutrophils may also frequently be seen in pleural and other body fluid specimens due to infection, inflammation, or peripheral blood contamination. Neutrophils range in diameter from 10 to 15µm, with moderate pale pink cytoplasm containing fine, eosinophilic granules. In reactive conditions, the cytoplasm may demonstrate toxic granulation or become vacuolated. The nucleus usually has three or four segments or lobes connected by a thin filament that contains no internal chromatin.

Body Fluid Photographs

CMP-11



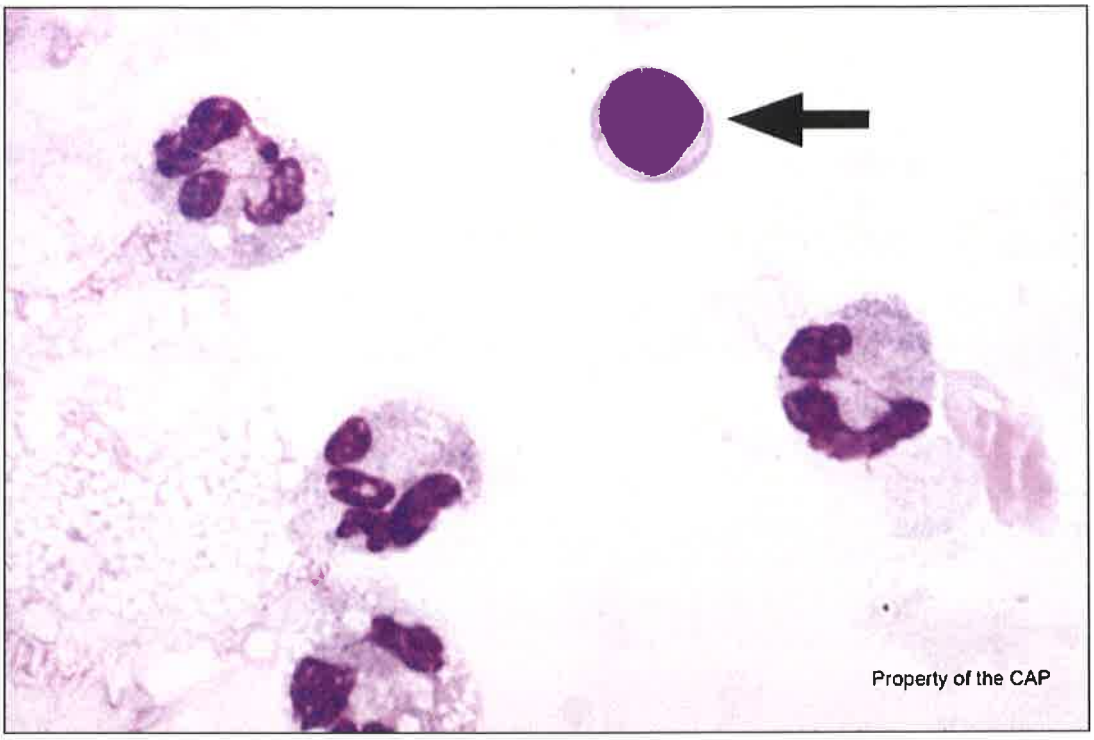
(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Mesothelial cells	3206	96.2	Good

The arrowed objects are mesothelial cells, as correctly identified by 96.2% of participants. These cells are normal lining cells of body cavity surfaces such as pleura and are usually present in corresponding body fluid samples in both clusters and individually due to shedding. Mesothelial cells are relatively large (20 to 50 µm) with moderate to abundant variably dense basophilic cytoplasm. Typically, nuclei are round to oval with regular nuclear contours, evenly distributed variably dense chromatin, and inconspicuous nucleoli. Reactive mesothelial cells may demonstrate increased size, multinucleation, or prominent nucleoli.

Body Fluid Photographs

CMP-12



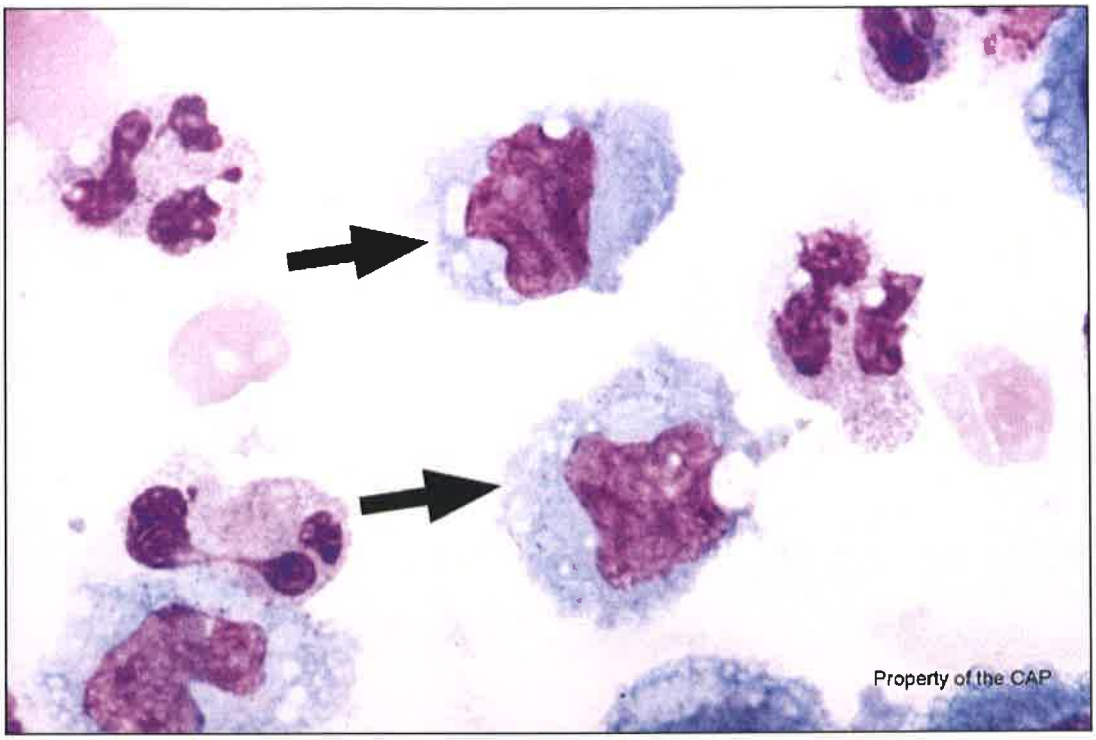
(PLEURAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Lymphocyte	3312	99.3	Educational

The arrowed object is a lymphocyte, as correctly identified by 99.3% of participants. A lymphocyte is a small, round to ovoid cell which may range in size from 7 to 15 µm with usually high but variable N:C ratios. While most lymphocytes are small with round to oval nuclei, some normal lymphocytes are medium-sized due to an increased amount of cytoplasm which occasionally may be granular. Chromatin is diffusely dense or coarse and clumped. Small lymphocytes usually have an inconspicuous nucleololus; although cytocentrifuge preparation can result in increased nucleolar prominence.

Body Fluid Photographs

CMP-13



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

Identification	CMP Participants No.	%	Performance Evaluation
Monocytes/macrophages	3278	98.3	Good

The arrowed objects are monocytes/macrophages, as correctly identified by 98.3% of participants. Monocytes are normal constituents of peripheral blood and give rise to macrophages, which evolve morphologically as they migrate into tissues as a response to various stimuli. Whereas typical blood monocytes range from 12 to 20 μm in diameter with indented nuclei and blue-gray vacuolated cytoplasm, macrophages are larger (15 to 80 μm) with more abundant cytoplasm showing evidence of active phagocytosis. Macrophage cytoplasm may contain abundant vacuoles, bacteria, fungi, hemosiderin, or other blood cells. Nuclei are usually round to oval with inconspicuous nucleoli.

Jay L. Patel, MD, FCAP
Roberta L. Zimmerman, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

Case History:
The patient is a 51-year-old man whose primary complaint is shortness of breath. Chest x-ray reveals the presence of pleural effusion. Pleural fluid sample laboratory findings include: WBC = 23,500/µL (23.500 × 10^3/µL); RBC = 71,500/µL (71.500 × 10^3/µL).

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

Case Discussion: Reactive Pleural Fluid

A pleural effusion is excess accumulation of fluid in the body cavity defined as the space between the chest wall and the pleural membrane surrounding the lungs. Patients with pleural effusion may present with symptoms of respiratory compromise such as shortness of breath, cough, or chest pain. The presentation of the effusion may be chronic to subacute in nature or represent an urgent clinical problem requiring intervention. Thoracentesis is a procedure that involves puncture of the pleural cavity and placement of a drain to remove excess pleural fluid resulting in improvement of related clinical symptoms. The removed pleural fluid is a relatively commonly encountered specimen type in the clinical laboratory and close examination may provide important information related to the cause of the effusion. In this sense, thoracentesis may be diagnostic and/or therapeutic.

Pleural effusions are often referred to clinically as either uncomplicated or complicated. This distinction rests on the cause of the fluid accumulation and whether there is an underlying infectious or systemic inflammatory etiology. Uncomplicated pleural effusion is often due to congestive heart failure and is usually transudative – which means the biochemical composition of the effusion is similar to normal pleural fluid. Complicated pleural effusion is usually due to infection or malignancy and is exudative in that the fluid contains excess protein, blood, or other evidence of infection or inflammation. A chylous effusion is a special type of effusion distinguished by the presence of neutral lipid in the form of lipophages. Chylous effusions are caused by compromise of the thoracic duct due to various causes and are classically milky white in gross appearance.

Knowledge of expected cell types populating body fluids is essential for proper interpretation of findings. Frequently encountered cells in pleural fluid examination include mesothelial (lining) cells, macrophages, lymphocytes, neutrophils, other white blood cells, and red blood cells. When erythrocytes are numerous, hemorrhage is a clinical consideration and the visual appearance of the sample (eg, clear, pink, frankly bloody, etc.) should be documented. Macrophages may sometimes be difficult to differentiate from mesothelial cells, which are usually larger and demonstrate characteristically biphasic cytoplasm staining. Mesothelial cells are often prominent in reactive pleural fluid and may show atypical features such as multinucleation, nuclear enlargement, and conspicuous nucleoli, which must be distinguished from malignancy. When present in clumps or pairs, mesothelial cells demonstrate discontinuous borders between cells that appear as clear spaces or "windows" and are a clue to their benign nature. Careful microscopic examination for microorganisms, particularly intracellular bacteria or fungi, is also crucial when examining body fluid specimens.

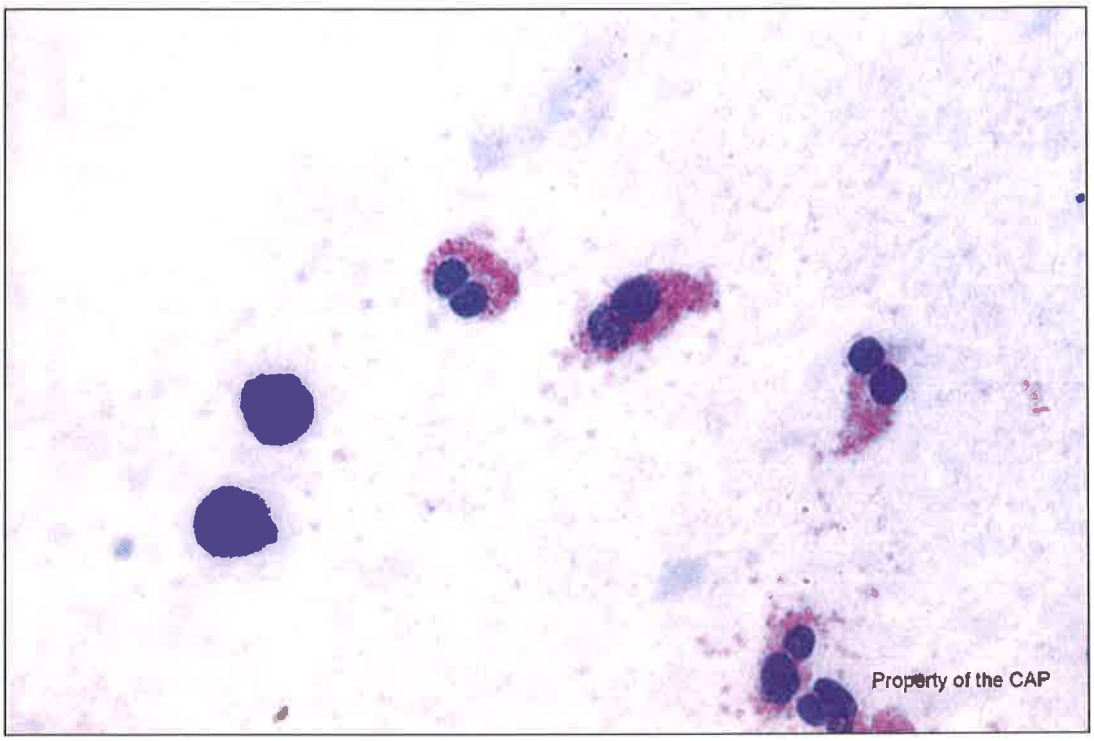
Jay L. Patel, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

References:

1. DeMay M. *Practical Principles of Cytopathology*. Chicago, IL: ASCP Press; 2007.
2. Hussong J, Kjeldsberg C. *Kjendsberg's Body Fluid Analysis*. Chicago, IL: ASCP Press; 2014.

CMMP – Clinical Microscopy Miscellaneous Photographs

CMMP-32



(NASAL, WRIGHT-GIEMSA)) High power magnification

Identification	CMMP Participants No.	%	Performance Evaluation
Eosinophils are present	2151	99.5	Good

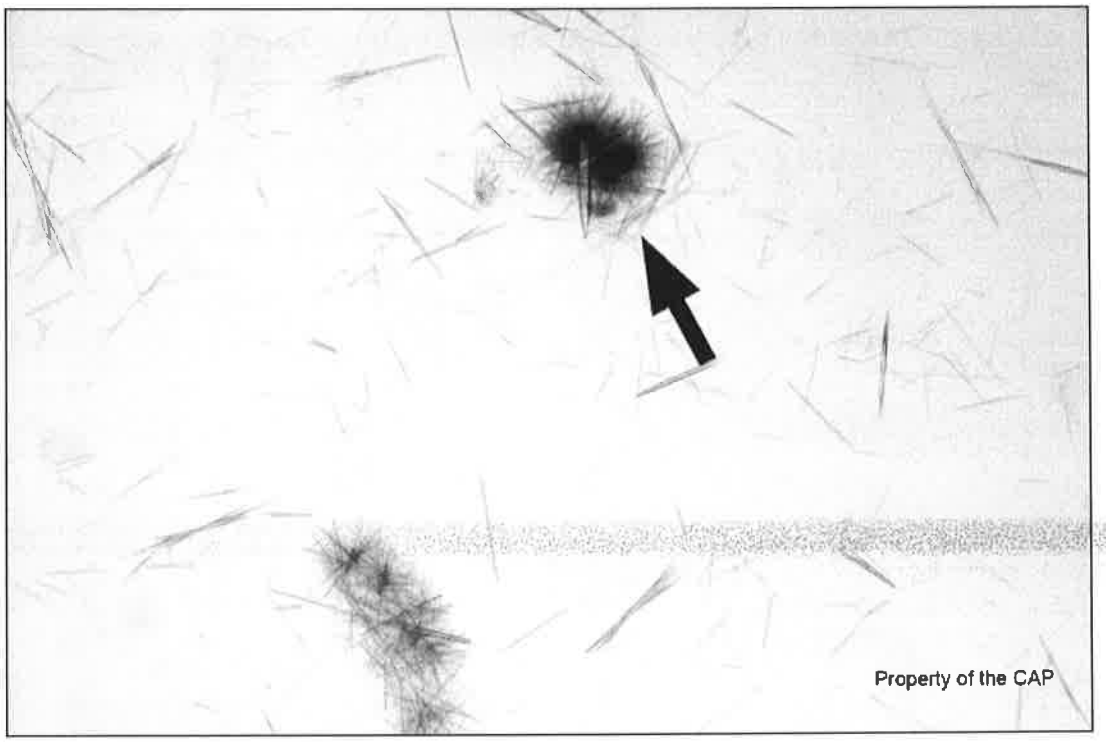
This photomicrograph of a Wright-Giemsa stained nasal smear has eosinophils present, which exhibit the typical bilobed nucleus and numerous cytoplasmic eosinophilic granules. Nasal smears for eosinophils are useful in distinguishing the nature of a nasal discharge, eosinophils being associated with allergic rhinitis. Nonallergic causes of nasal discharge will typically be acellular or show a predominance of neutrophils.

CMMP – Urine Sediment Color Photographs

Case History USP-01 through USP-04

This urine sample is from a 56-year-old male with kidney and liver failure. Laboratory data include: specific gravity = 1.012; pH = 5.0; blood, protein, and leukocyte esterase = positive; glucose, ketones, and nitrite = negative. Ictotest is positive. Crystals are threadlike and highly refractile. A second crystal, leucine, is also present in this urine sample.

USP-01



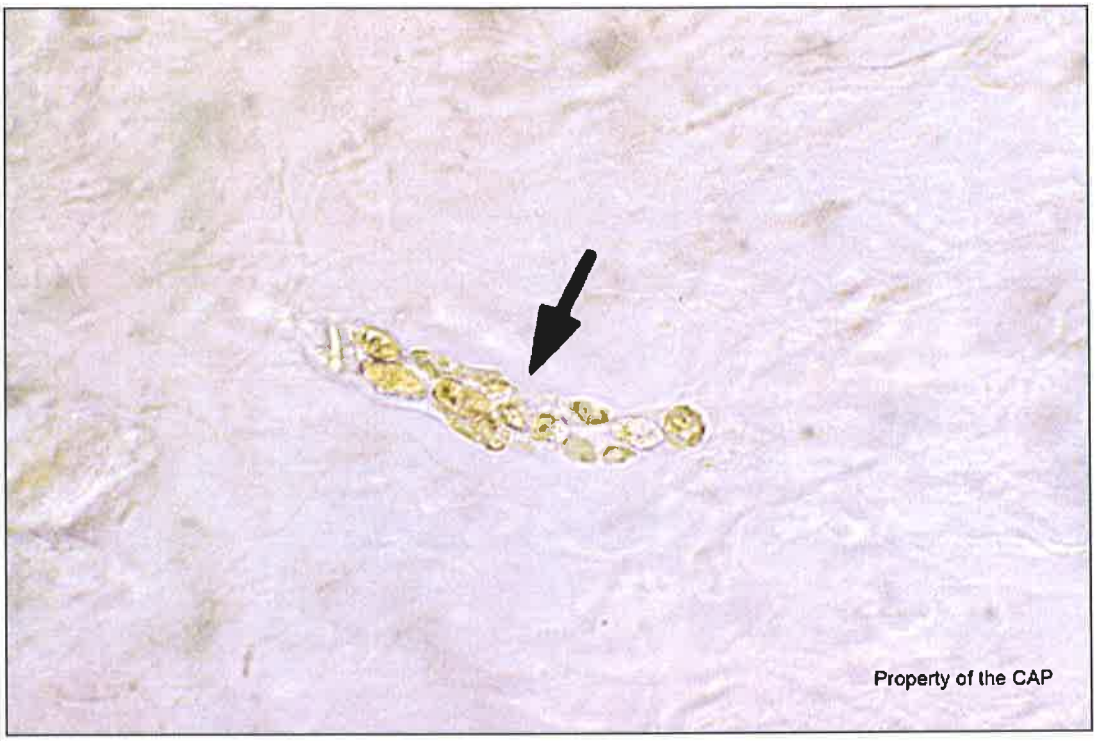
(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Tyrosine crystal	3468	95.8	Good

The arrowed object is a tyrosine crystal, as correctly identified by 95.8% of participants. Tyrosine crystals are seen at neutral or acid pH, and are present as silky, fine, colorless to black needle-shaped crystals. The crystals may clump or form sheaves upon refrigeration. Tyrosine crystals may be seen in hereditary tyrosinosis or with hepatic failure.

CMMP – Urine Sediment Color Photographs

USP-02



(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Cellular cast (RTE and/or neutrophil)	3529	97.5	Good

The arrowed object is a cellular cast, as correctly identified by 97.5% of participants. Cellular casts can be composed of either neutrophils or renal tubular epithelial (RTE) cells. RTE cases are associated with diseases which damage the renal tubules, while neutrophil casts are associated with infection. In this example, the cells are lined up on the surface of the cast and have single nuclei, consistent with an RTE cast. In addition, the cells are bile-stained, consistent with the history of liver failure. Cellular degeneration can make it difficult to distinguish WBC casts from RTE casts. However, the distinction of cellular casts from other types of casts is important given the clinical severity of the associated disease states (acute infection or acute renal tubule damage).

CMMP – Urine Sediment Color Photographs

USP-03

(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Leukocyte (neutrophil, eosinophil, lymphocyte)	3488	96.3	Good

The arrowed object is a leukocyte, as correctly identified by 96.3% of participants. The most common leukocyte found in urine is the neutrophil; other leukocytes which may be present are eosinophils and lymphocytes. Neutrophils in urine are 10-12 µm in diameter, round, oval or amoeboid, with a segmented, lobulated or fused (in degenerated specimens) nucleus. The chromatin is coarsely granular or clumped and the cytoplasm is granular. Small numbers of leukocytes (up to 5) are normal. The presence of larger numbers of neutrophils indicates inflammation, and many and/or clumped neutrophils is strongly suggestive of acute infection.

CMMP – Urine Sediment Color Photographs

USP-04

(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Mucus strands	3578	98.8	Good

The arrowed objects are mucus strands, as correctly identified by 98.8% of participants. Mucus strands or threads are delicate, irregular and translucent and may be better seen on phase microscopy. They may also form long intertwined aggregates. Mucus is normally secreted from glands in the lower urinary and vaginal tracts are frequently found in urine samples.

Megan O. Nakashima, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

COLLEGE of AMERICAN PATHOLOGISTS

Attestation of Participation for Self-Reported Training*

We the participants below have completed the review of the CAP CM-A 2016 (Product Mailing, Year) Participant Summary/Final Critique report, and can self report the recommended 0.5 (Education Hours) hours towards fulfilling education and certification of maintenance requirements.

Participant	Date	Participant	Date

Director (or Designee) Signature - I have verified that the individuals listed above have successfully participated in this activity.

Date

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For assistance, call our Customer Contact Center at 800-323-4040 or 847-832-7000 option 1.

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