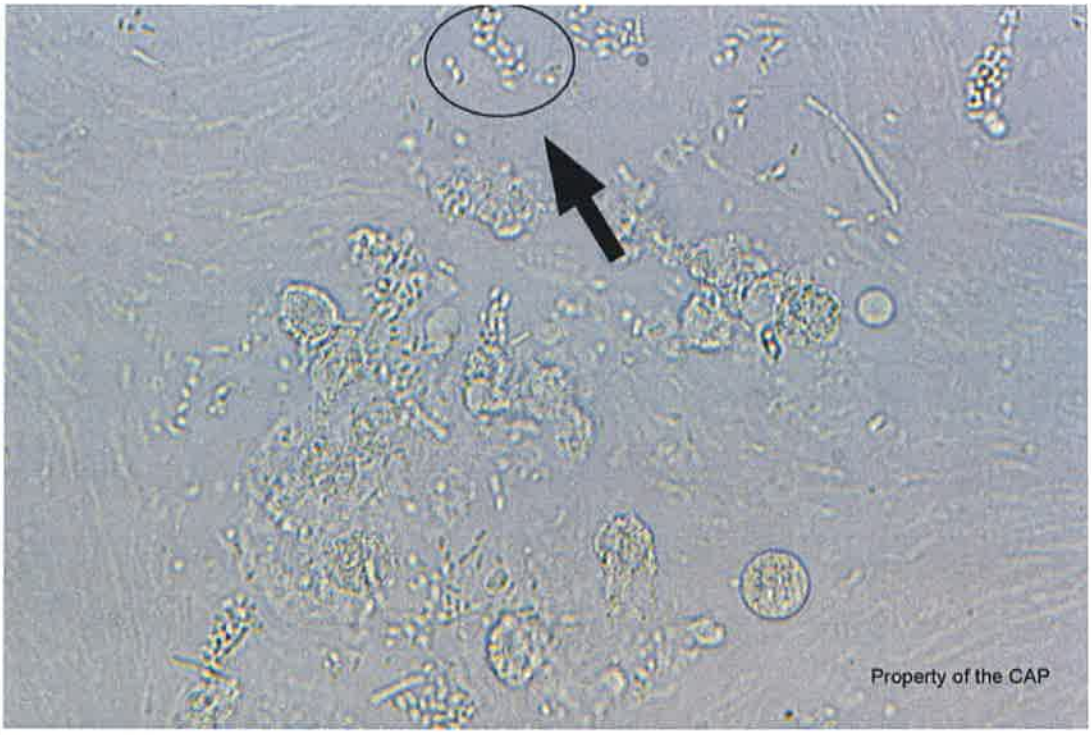
Urine Sediment Photographs

Case History CMP-17 through CMP-20

This urine sample is obtained from a 28-year-old woman presenting with nausea and vomiting, fever and unilateral flank pain, and urgency for urination. Laboratory data include: Specific gravity = 1.006; pH = 8.0; blood, leukocyte esterase, nitrite, protein = positive; glucose and ketones = negative.

CMP-17



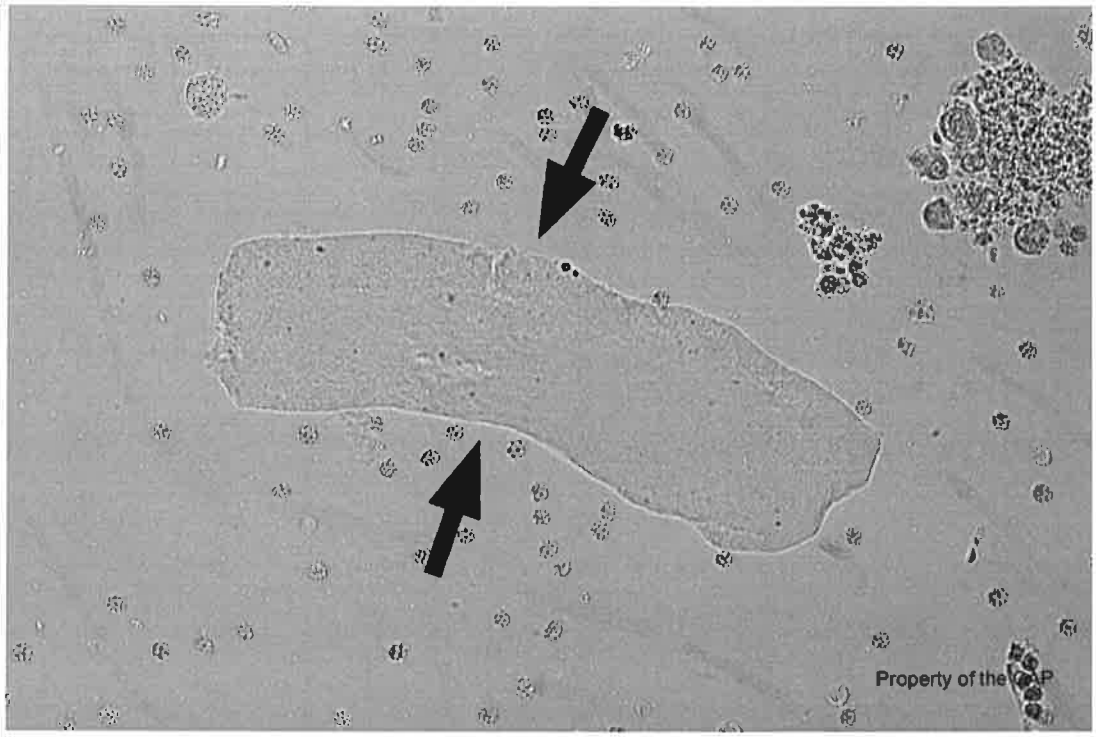
(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Bacteria	4999	81.0	Good
Yeast/fungi	1010	16.4	Unacceptable

The circled area indicated by the arrow contains bacteria, as correctly identified by 81.0% of participants. Bacteria may be cocci or rod forms in urine. Cocci in a wet mount may resemble amorphous material. Rod forms may be short or long. Smaller numbers of bacteria may be normal in urine, particularly from females, due to contamination during collection. Large numbers of bacteria in the urine may indicate infection. Yeast should not be confused with bacteria. Yeast forms measure 5-7 microns, much larger than bacteria. Yeast forms also have an oval shape, thick walls and often show budding.

Urine Sediment Photographs

CMP-18



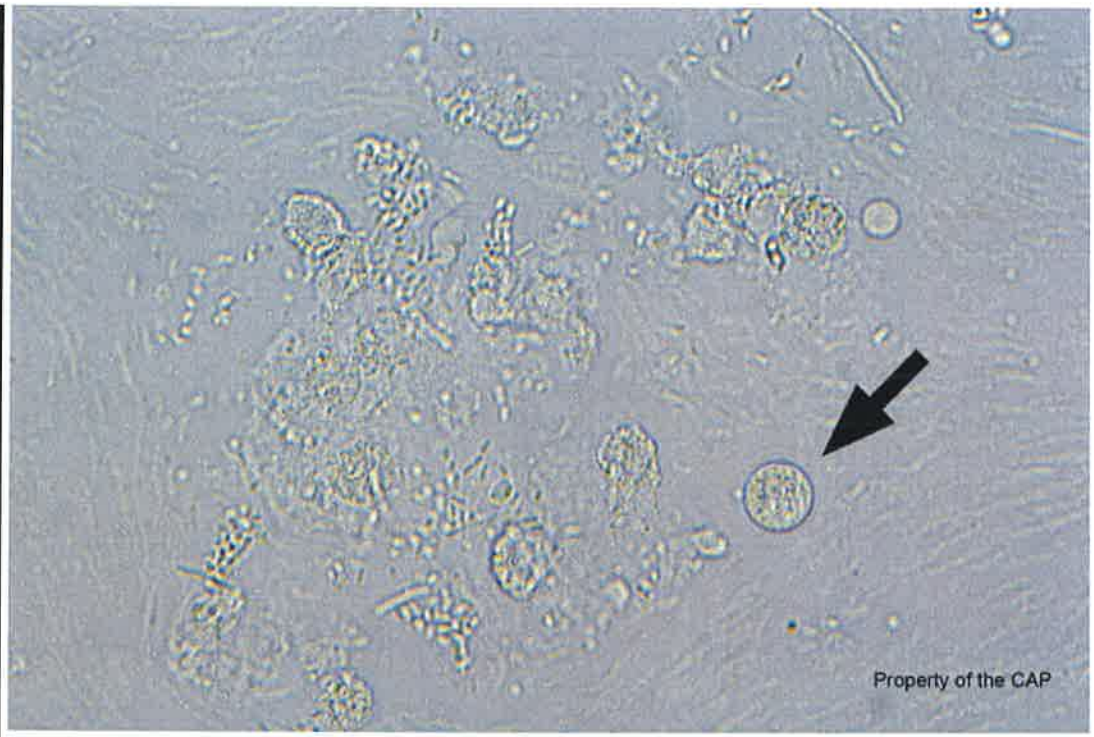
(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Waxy Cast	5085	82.3	Good
Hyaline Cast	965	15.6	Unacceptable

The arrowed object is a waxy cast, as correctly identified by 82.3% of participants. Waxy casts are colorless or pale yellow, wide short casts. They have parallel, well-defined sides with occasional notches or cracks. The interior appears dense and homogenous. Waxy casts do not polarize. They may be confused with fibers, particularly wood fibers from diapers. Wood fibers generally have fibrillary ends and some interior structure or pitting. Waxy casts are associated with severe renal disease and are always a significant finding. They are the end product of degenerated granular and other casts and are also known as "renal failure casts." They are wider than most other crystals because they form in dilated damaged tubules in the kidney. Hyaline casts differ from waxy casts in several ways. Hyaline casts are nearly transparent, have rounded or tapered ends, and are narrower than waxy casts. Hyaline casts may be seen in urine from from healthy individuals.

Urine Sediment Photographs

CMP-19



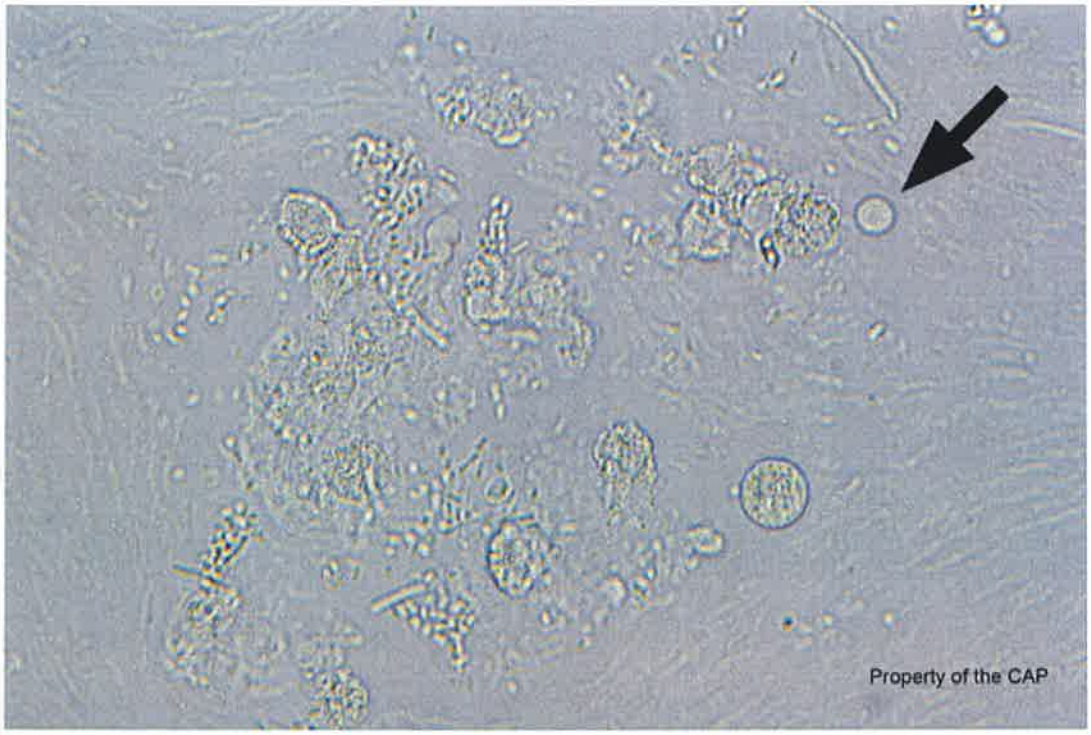
(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Leukocyte	6104	98.9	Good

The arrowed objects are leukocytes, as correctly identified by 98.9% of participants. The majority of leukocytes in urine are neutrophils. In fresh specimens, the nucleus may appear segmented. Generally, they appear as colorless granular cells averaging 10-12 microns in width. They often swell in dilute urine up to 20-30 microns, and lose nuclear definition rapidly as they age. Small numbers are normal and increased numbers may indicate infection or nephritis.

Urine Sediment Photographs

CMP-20



(URINE, UNSTAINED, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Erythrocyte	6106	99.0	Good

The arrowed objects are erythrocytes, as correctly identified by 99.0% of participants. Red blood cells in urine are very pale yellow-orange or colorless discs measuring 7-8 microns. Their biconcave shape may be evident. They swell in hypotonic urine or become shrunken and crenated in hypertonic urine. Small numbers are found in normal urine. Large numbers are seen in bladder or urinary tract disease, trauma or bleeding disorders. Red blood cells may be confused with air bubbles, fat droplets or starch granules. Air bubbles vary in size and have dark refractile peripheries. Fat droplets also vary in size, unlike red blood cells. Starch granules often have a central slit or indentation.

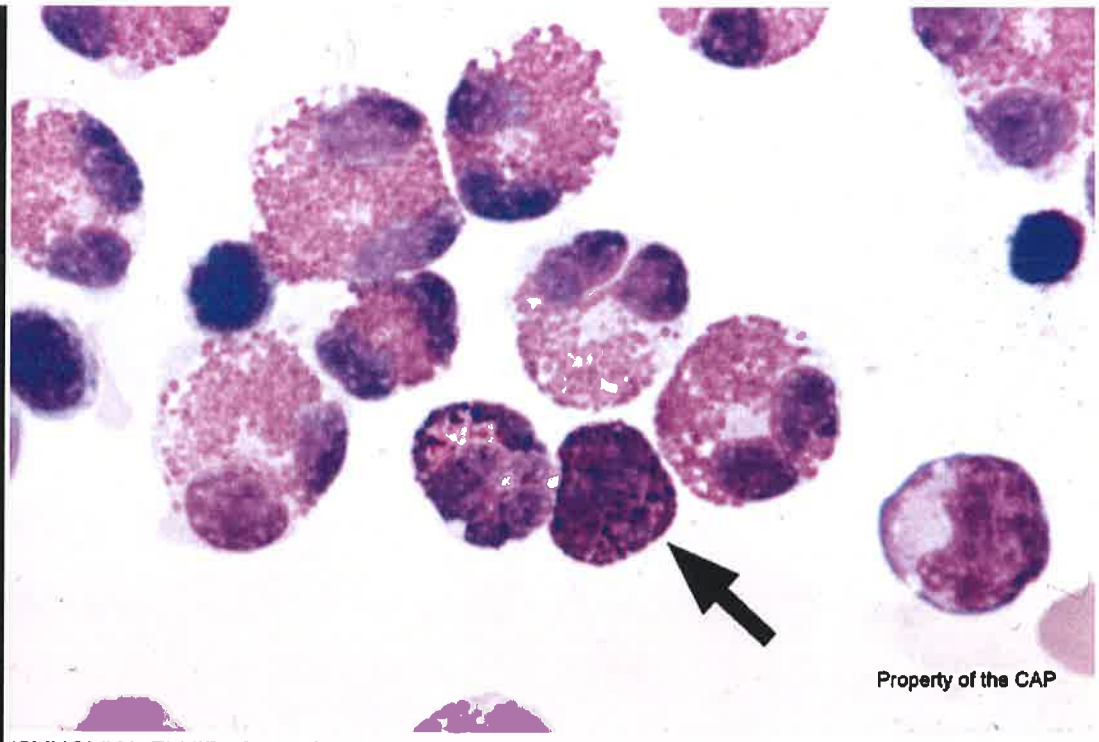
Roberta L. Zimmerman, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

Body Fluid Photographs

Case History CMP-21 through CMP-26

The patient is a 21-year-old woman presenting with an effusion of the left knee. Synovial fluid sample laboratory findings include: WBC = 10,230/µL (10.230 × 10E3/µL); and RBC = 2,468/µL (2.468 × 10E3/µL).

CMP-21



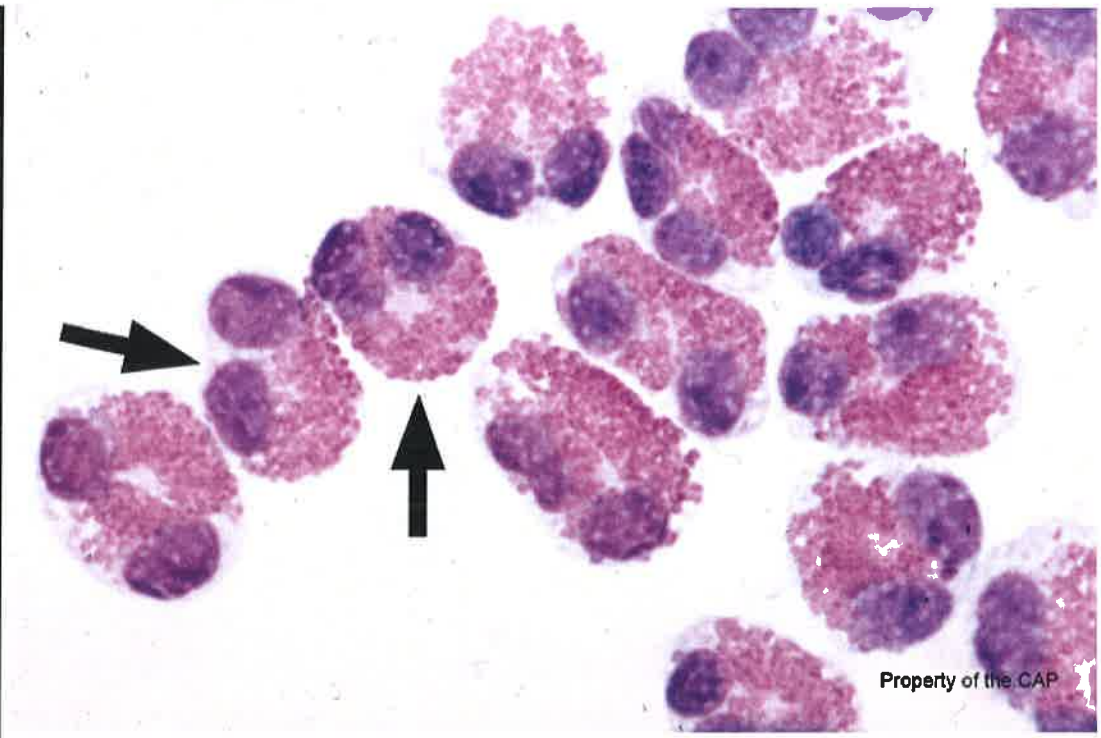
(SYNOVIAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Basophil	3406	98.7	Educational

The arrowed object is a basophil, as correctly identified by 98.7% of participants. Basophils are the same size of neutrophils, approximately 10 to 15 µm. They are characterized by the presence of a moderate number of unevenly distributed, coarse and densely stained dark blue to black granules of varying sizes. These granules frequently overlay and obscure the nucleus. Basophils are not typically observed in body fluids. When present, they are most commonly associated with inflammatory conditions, foreign body reactions, and parasitic infections.

Body Fluid Photographs

CMP-22



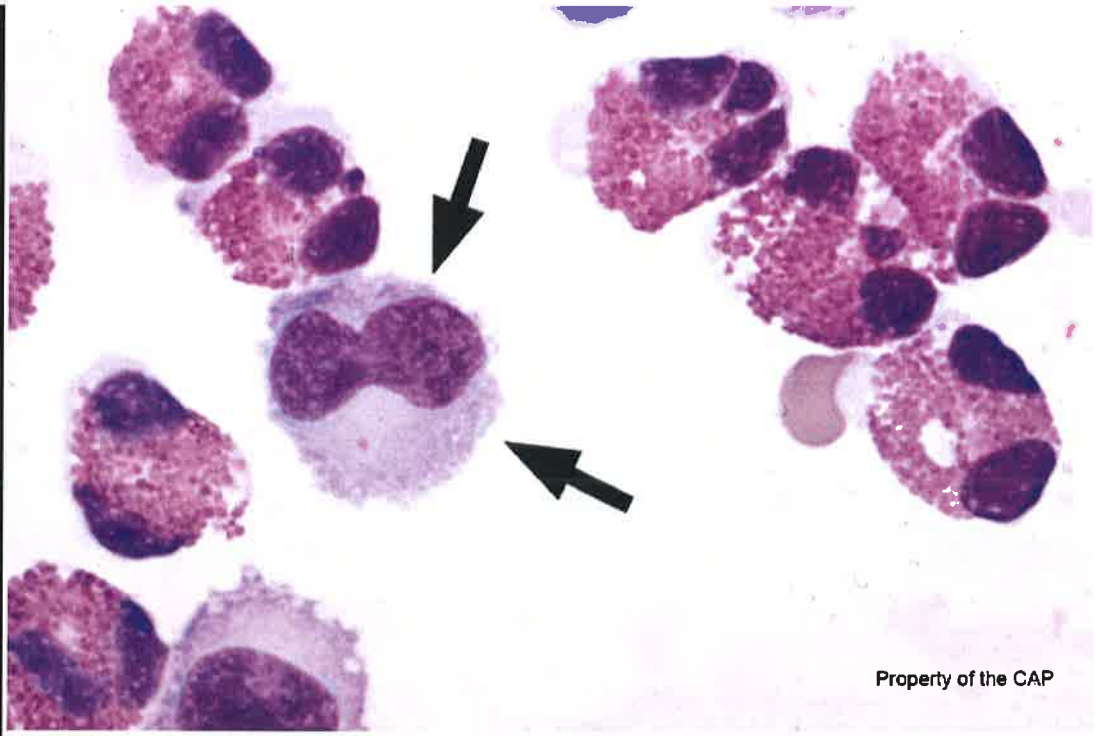
(SYNOVIAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Eosinophil	3449	99.9	Good

The arrowed objects are eosinophils, as correctly identified by 99.9% of participants. Eosinophils are round to oval leukocytes, measure 10 to 15 µm, and have characteristic, uniformly-sized, round, orange-pink to orange-red granules on Wright Giemsa stains. These granules are larger than neutrophilic primary or secondary granules. In this case, numerous eosinophils are seen and predominate, raising suspicion for a pathologic process such as that seen in foreign body reactions and parasitic infections (case discussion to follow).

Body Fluid Photographs

CMP-23



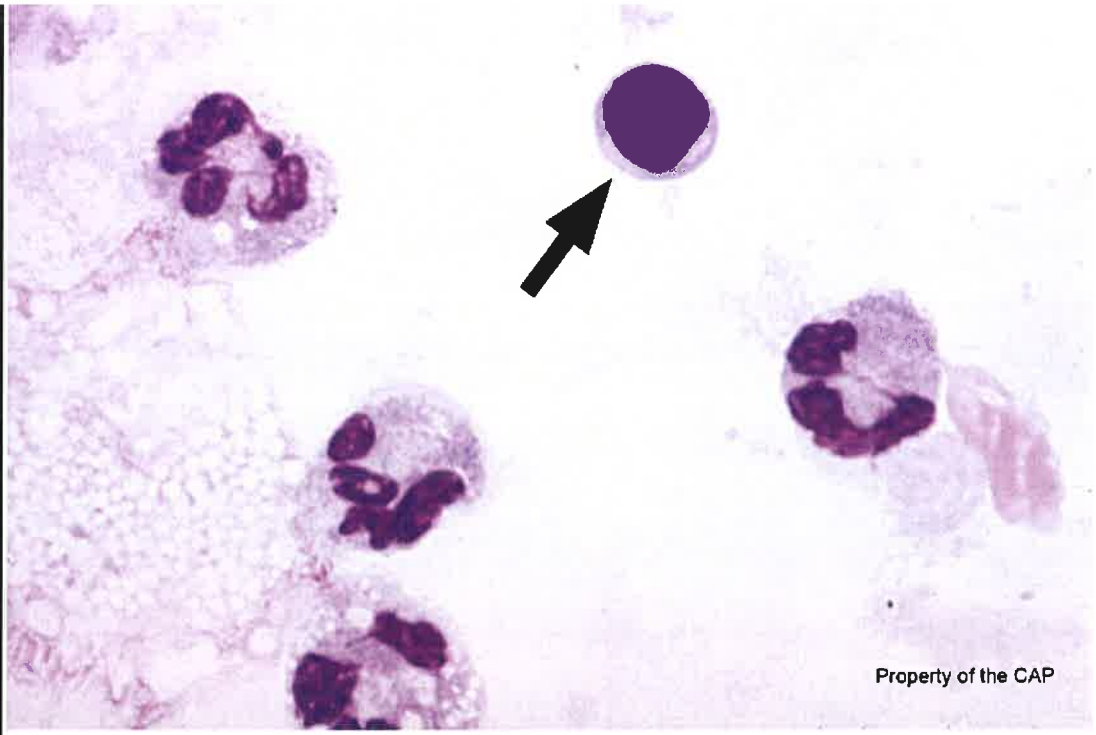
(SYNOVIAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Monocyte/macrophage	2931	85.0	Educational

The arrowed object is a monocyte/macrophage, as correctly identified by 85.0% of participants. Monocytes are normal constituents of peripheral blood, which may migrate into tissues to evolve morphologically into macrophages. In body fluids, there is a continuum of morphology from the typical peripheral blood monocyte to the vacuolated, activated stage of the typical macrophage. Monocytes are large, typically measuring 12 to 20 µm, with moderate to abundant blue-gray cytoplasm and reniform/kidney-bean shaped nuclear contours, lacy chromatin, and inconspicuous nucleoli. Macrophages are even larger (15 to 80 µm) with abundant vacuolated cytoplasm, showing evidence of active phagocytosis.

Body Fluid Photographs

CMP-24



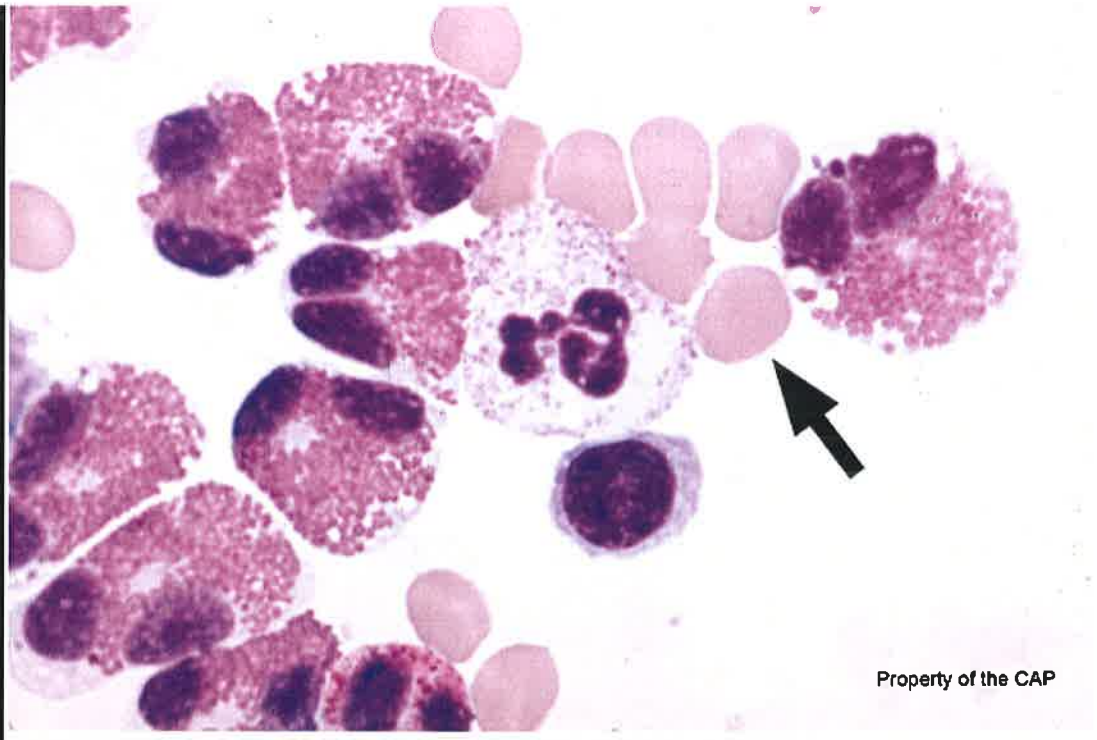
(SYNOVIAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Lymphocyte	3441	99.7	Good

The arrowed object is a lymphocyte, as correctly identified by 99.7% of participants. Normal lymphocytes may exhibit a spectrum of morphology. In this cell ID, the lymphocyte is small (approximately 7-10 µm) with a high N:C ratio, round nucleus, smooth nuclear contours, coarsely clumped chromatin, absent nucleolus, and scant amount of pale blue agranular cytoplasm. Cytologic features of lymphocytes prepared by cytocentrifugation may display features slightly different from those in seen blood smears, including cytoplasmic spreading, nuclear convolutions, and nucleolar prominence.

Body Fluid Photographs

CMP-25



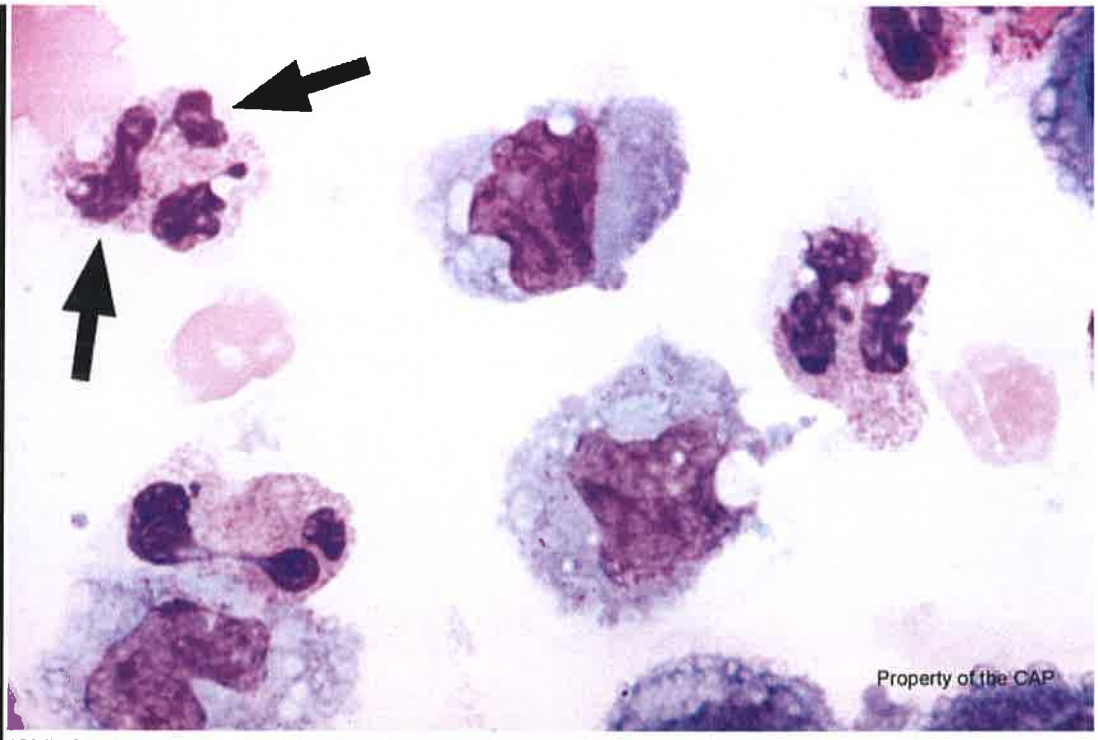
(SYNOVIAL FLUID, CYTOCENTRIFUGE, WRIGHT-GIEMSA, 100X)

Identification	CMP Participants No.	%	Performance Evaluation
Erythrocyte	3452	99.9	Good

The arrowed objects are erythrocytes or red blood cells, as correctly identified by 99.9% of participants. These non-nucleated erythroid cells are biconcave, disc-shaped cells containing hemoglobin, and stain uniformly pink-red. They have a zone of central pallor that occupies one-third of the cell diameter. They are not typically found in normal body fluid samples, and when seen in large numbers, reflect hemorrhage or traumatic contamination.

Body Fluid Photographs

CMP-26



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

Identification	CMP Participants No.	%	Performance Evaluation
Neutrophil	3341	96.8	Good

The arrowed object is a neutrophil, as correctly identified by 96.8% of participants. Segmented neutrophils are mature granulocytes, measuring 10 to 15 µm, and are typically the predominant white blood cell type in peripheral blood. They are readily appreciated by their characteristic multilobated nucleus (3 to 5 lobes typically), with lobes connected by thin, thread-like filaments. They have moderate amounts of pale pink cytoplasm with specific (fine, eosinophilic/azurophilic) granules. In cytocentrifuge body fluid preparations, neutrophils may display morphologic changes from autolysis, including nuclear pyknosis and fragmentation.

Maria Vergara-Lluri, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

Case Presentation:
The patient is a 21-year-old woman presenting with an effusion of the left knee. Synovial fluid sample laboratory findings include: WBC = 10,230/µL (10.230 × 10E3/µL); and RBC = 2,468/µL (2.468 × 10E3/µL).

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

Case Discussion: Eosinophilic Synovitis

Synovial fluid is normally present in scant amounts, just enough to lubricate joint surfaces. It contains very few cells, with no erythrocytes and less than 200 leukocytes per milliliter, neutrophils being no more than 25% of leukocytes. Clinicians strongly consider synovial fluid aspiration and analysis when patients present with monoarthritis, trauma with joint effusion, crystal-induced arthritis (eg, gout, pseudogout), hemarthrosis, and joint infections. Analysis of synovial fluid includes examination of its gross appearance, viscosity, cell count, differential, Gram stain with culture and sensitivity (if indicated), and crystal identification.[1,2]

Synovial fluid eosinophilia (SFE) (also known as eosinophilic synovitis) is thought to be an uncommon occurrence, with incidence varying from 0.11% to 1.02% as reported in the literature.[3] However, there is no agreement on the definition of SFE and long-term follow-up is sparse. Some authors define SFE as the presence of eosinophils in synovial fluid at any percentage; some with a differential count of >2% eosinophils; and still others ascribe the name only in cases when eosinophils are >10% of the differential count. As in any fluid or tissue, massive accumulation of eosinophils can sometimes result in the formation of Charcot-Leyden crystals. Bright orange-pink to orange red, bipyramidal hexagons, Charcot-Leyden crystals are composed of crystallized lysolecithinase from eosinophils.[2]

SFE has been reported to occur in a broad range of settings; therefore, its finding must be correlated clinically. Conditions that have been reported include rheumatologic disease (ie, rheumatoid arthritis, psoriatic arthritis), parasitic arthritides (eg, Guinea worm, Strongyloides), Lyme disease, septic arthritis, pseudogout, hemarthrosis, post-arthrography, pharmacological eosinophilia, chronic myeloid leukemia, pseudo-allergic (in atopic patients), allergic disease with arthritis (ie, urticaria and angioedema), metastatic malignancy to synovium, postradiation therapy, and rarely, hypereosinophilic syndromes.[2,3] When no cause can be attributed to the SFE, it is then considered idiopathic.

Concurrent and severe peripheral blood eosinophilia is not detected in most cases. Interestingly, conditions that incite intense peripheral eosinophilia (like hypereosinophilic syndrome, Churg-Strauss syndrome, etc.) do not usually cause arthritis and/or synovitis. When synovitis does occur in these settings, they only rarely present as SFE. Investigators that reported long-term follow-up in their patient cohort concluded that SFE is associated with a benign course of arthritis with prompt resolution and few relapses.[3]

Maria Vergara-Lluri, MD, FCAP
Hematology and Clinical Microscopy Resource Committee

References:

1. Galagan KA, Blomberg D, Cornbleet PJ, Glassy P. *Color Atlas of Body Fluids: An Illustrated Field Guide Based on Proficiency Testing.* Northfield, Illinois: College of American Pathologists; 2006:88-95.
2. Hussong JW, Kjeldsberg CR. *Kjeldsberg's Body Fluid Analysis: Synovial Fluid.* Chicago, Illinois: American Society of Clinical Pathologists Press; 2015:137-160.
3. Vázquez-Triñanes C, Sopeña B, González-González L, et al. Synovial fluid eosinophilia: a case series with long follow-up and literature review. *Rheumatol.* 2013;53:346-351.

CMMP – Urine Sediment Color Photographs

Case History USP-05 through USP-08

This urine sample is obtained from a 48-year-old male presenting with a 30-year history of diabetes mellitus and new onset renal failure. Laboratory data include: Specific gravity = 1.010; pH = 6.5, blood, protein, ketones and glucose = positive; leukocyte esterase and nitrites = negative.

USP-05

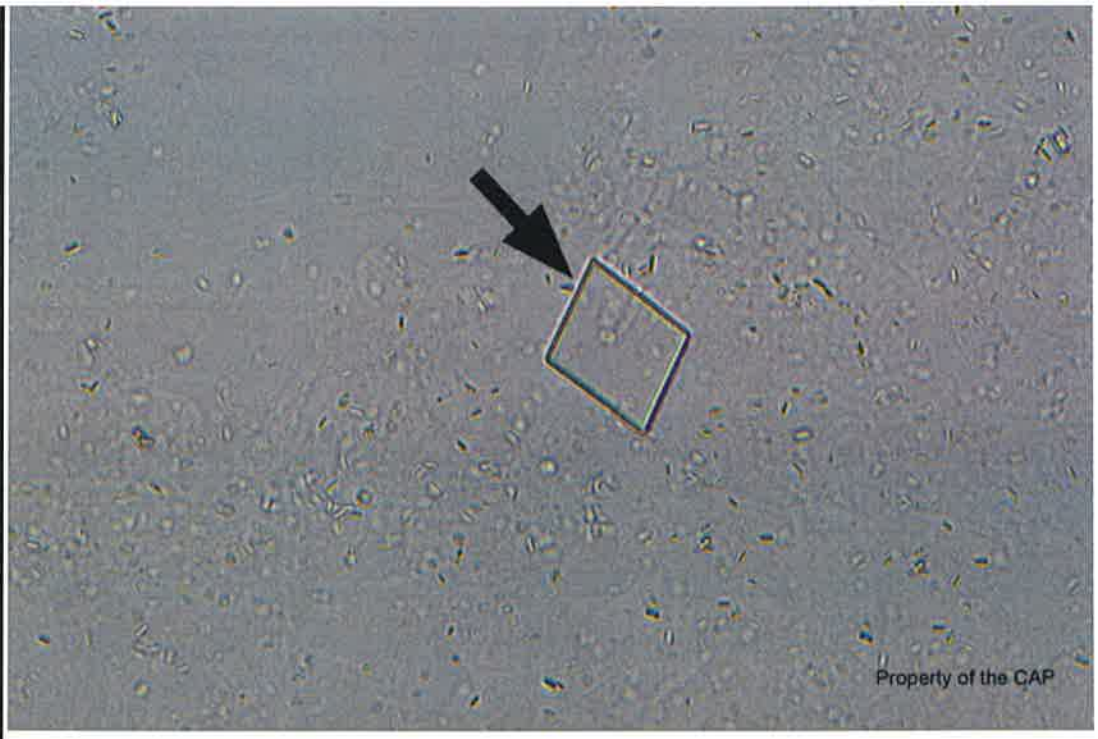
(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Erythrocyte	3500	98.0	Good

The arrowed object is an erythrocyte, as correctly identified by 98.0% of participants. Unstained erythrocytes in urine generally present as pale yellow-orange discs, but may be colorless in older or hypotonic specimens. They are generally 7 to 8 µm in diameter, although this may vary. Hypertonic urine may result in cells shrinking and becoming crenated. Erythrocytes can be seen in small numbers in healthy patients. However greater numbers are usually observed with various pathologies including urinary tract neoplasms, infections, trauma, glomerular disease, and urinary tract calculi. Increased erythrocytes can also be seen in patients with systemic bleeding or anticoagulant therapy.

CMMP – Urine Sediment Color Photographs

USP-06



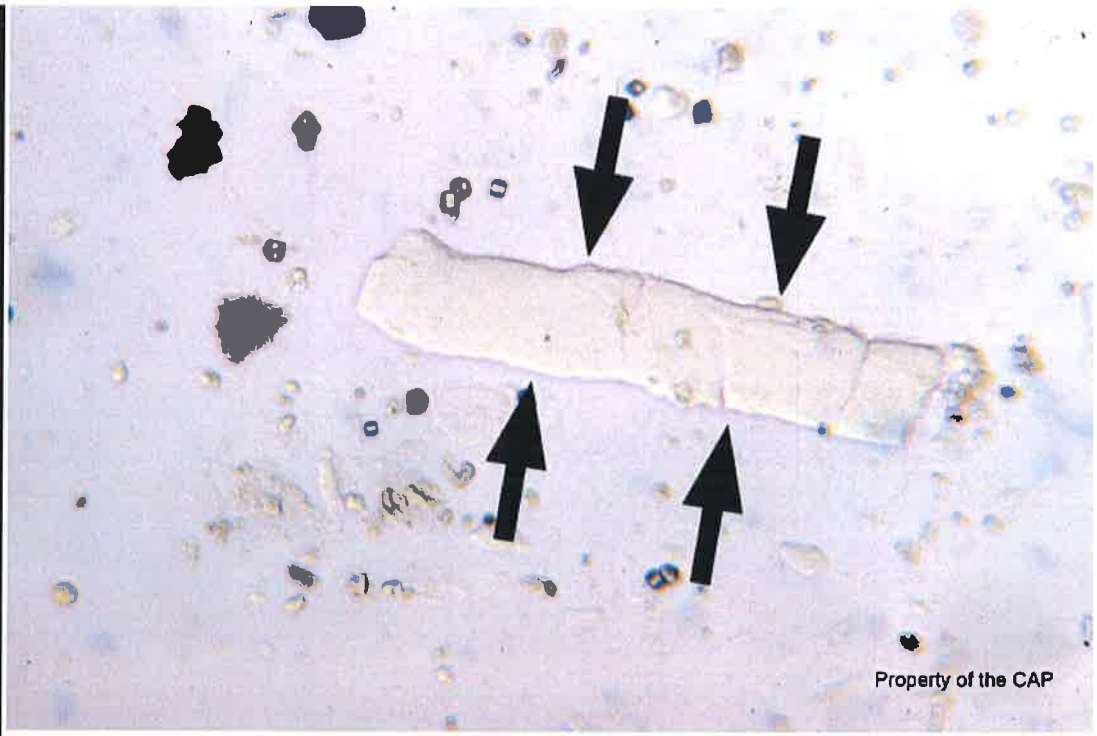
(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Uric acid crystal	3089	86.4	Good

The arrowed object is a uric acid crystal, as correctly identified by 86.4% of participants. Uric acid crystals are observed at low (acid) pH. They are yellow to brown in color and birefringent. The typical shape is rhomboid, although they may also be hexagonal. Uric acid can also create a variety of structures which resemble stars, prisms, cubes, rosettes, whetstones and lemons. Although uric acid crystals are seen in normal acid urine, a large number present in freshly voided urine, or association with erythrocytes, renal tubular cells and casts or symptoms of nephrolithiasis may be a sign of uric acid nephrolithiasis.

CMMP – Urine Sediment Color Photographs

USP-07



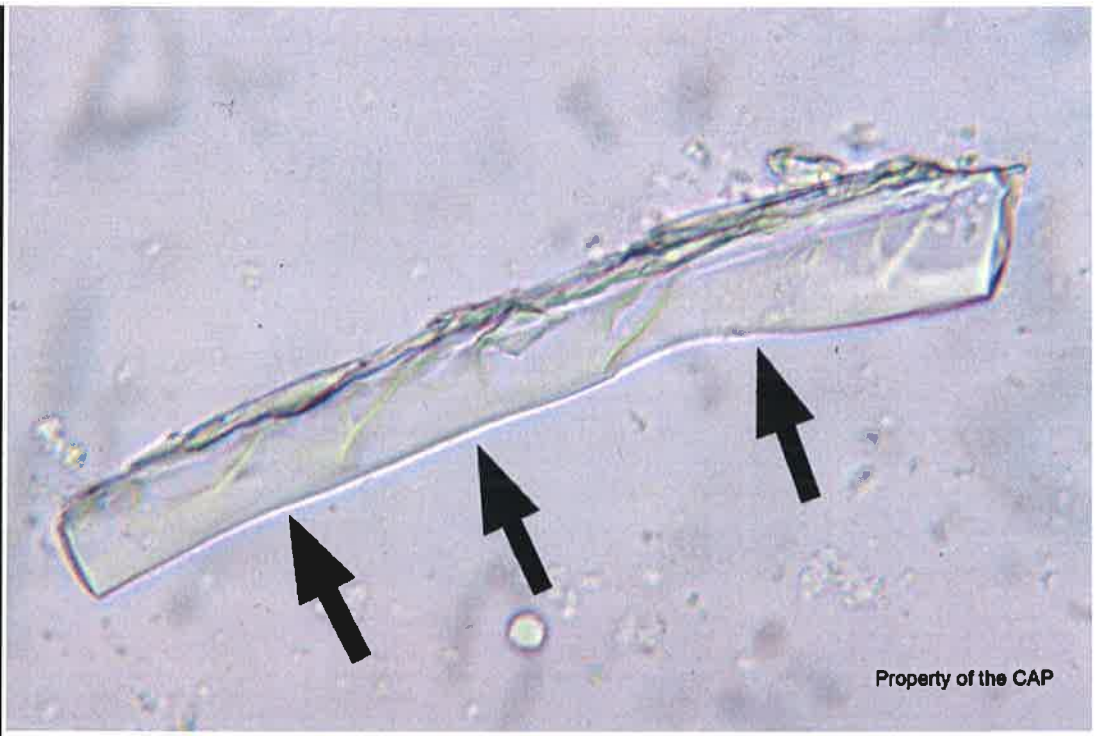
(URINE, UNSTAINED, 100X)

Identification	CMMP Participants No.	%	Performance Evaluation
Waxy cast	3482	97.2	Good

The arrowed object is a waxy cast, as correctly identified by 97.2% of participants. These casts are characteristically short and wide/broad and have a high refractive index. The ends are blunt and may appear to have been broken off. The margins are parallel and well-defined but may contain cracks or notches. The material is dense and homogenous and may be either clear or yellow. Waxy casts are thought to develop through degeneration of cellular casts, usually in the context of severe/end stage renal disease.

CMMP – Urine Sediment Color Photographs

USP-08



(URINE, UNSTAINED, 100X)

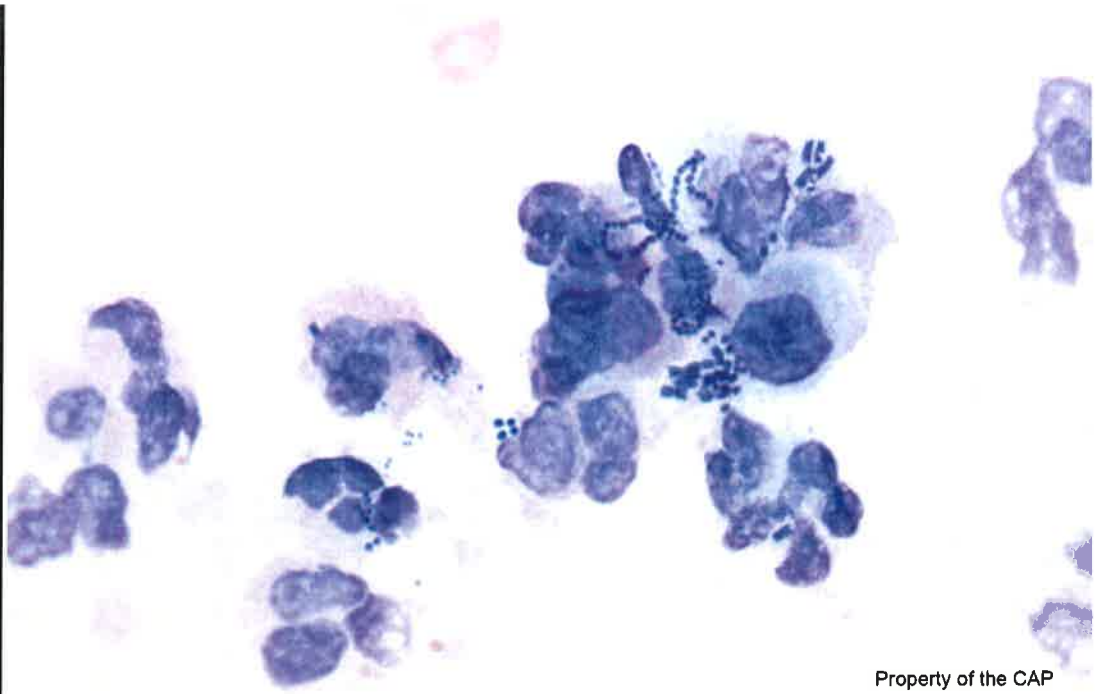
Identification	CMMP Participants No.	%	Performance Evaluation
Fiber (exogenous)/fecal contamination	3468	96.9	Good

The arrowed object is a fiber (exogenous)/fecal contaminant, as correctly identified by 96.9% of participants. Exogenous fibers can be seen due to contamination from clothing, bed linens, dressings, and diapers. Most are long, highly refractile and occasionally twisted, which helps distinguish them from casts. The margins may be non-parallel or frayed. Cellulose fibers from disposable diapers may mimic waxy casts but are birefringent and typically have more internal structure without the dense "waxy" appearance of waxy casts. Fecal material can also be seen in urinary specimens due to fistulas or contamination during collection. Structures seen can include plant materials, muscle fibers and starch granules.

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

CMMP – Clinical Microscopy Miscellaneous Photographs

CMMP-38



(NASAL, WRIGHT-GIEMSA))

High power magnification

Identification	CMMP Participants No.	%	Performance Evaluation
Eosinophils are absent	1997	98.1	Good

This nasal smear is negative for eosinophils. 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 to transfer the mucus to a glass slide. A thin smear is prepared and allowed to air dry. Staining may be performed using a Wright-Giemsa stain or a Hansel stain. Eosinophils are recognized microscopically by their typically bilobed nuclei and characteristic eosinophilic granules.