

Susan E. Fielder, DVM, MS, Diplomate ACVP,
 Texas Veterinary Medical Diagnostic Laboratories, &
 Theresa E. Rizzi, DVM, Diplomate ACVP, Oklahoma State University

Urine Crystals in Dogs & Cats

Microscopic examination of urine sediment should be included as part of a complete urinalysis. Crystalluria is not typically of clinical significance and is often not associated with urolithiasis; however, the presence of abnormal crystals or large numbers of common crystals may indicate disease.

Metabolism, diet, underlying disease, sample collection, sample storage, and iatrogenic causes (eg, drug or IV contrast agent administration) may contribute to crystalluria. Crystal formation is often dependent on urine pH, osmolality, and temperature, as well as concentration and solubility of the crystal-forming material. Identification of urine crystals is typically based on their shape and color.

Match each of the pictures provided to one of the urine sediment findings listed below. Each finding corresponds with only 1 picture.

See pages 74-75 for answers.

___ AMMONIUM BIURATE CRYSTALS

___ CYSTINE CRYSTALS

___ BILIRUBIN CRYSTALS

___ HEMOGLOBIN PRECIPITATES

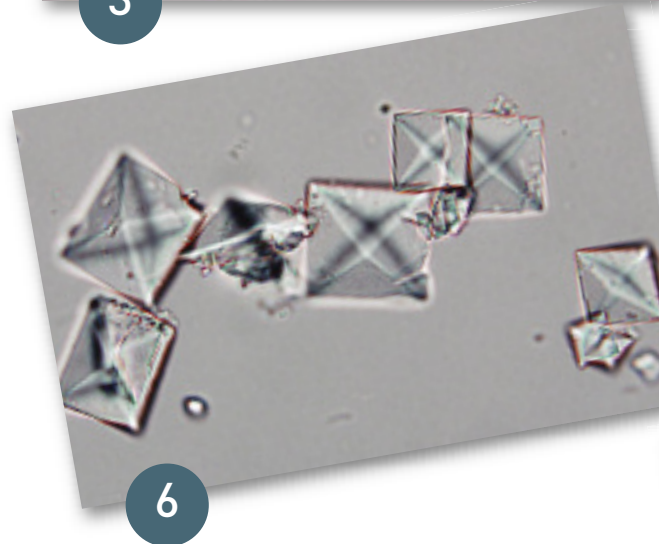
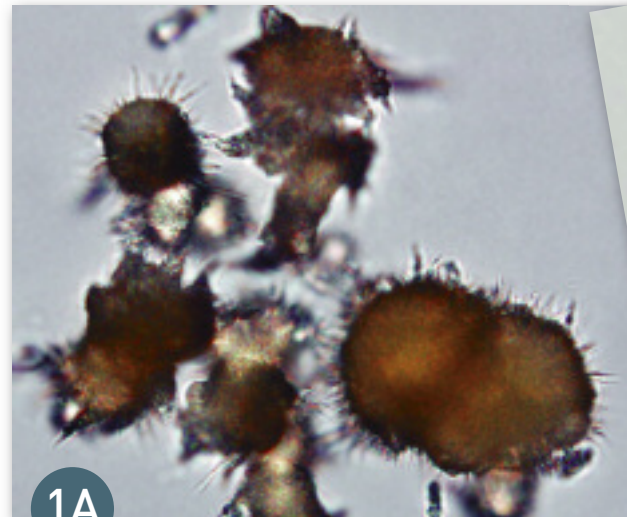
___ CALCIUM OXALATE DIHYDRATE CRYSTALS

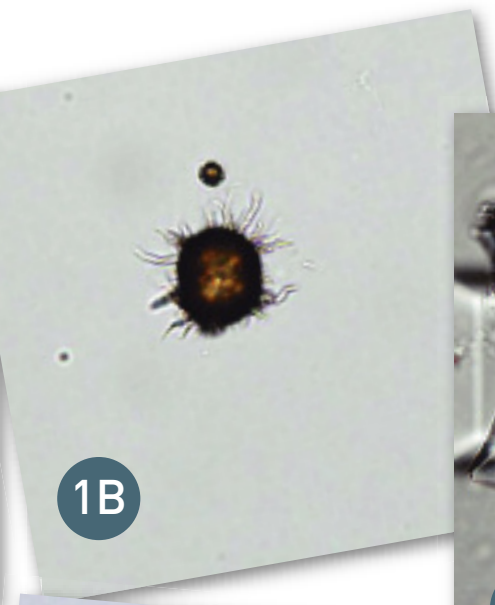
___ MELAMINE CYANURATE CRYSTALS

___ CALCIUM OXALATE MONOHYDRATE CRYSTALS

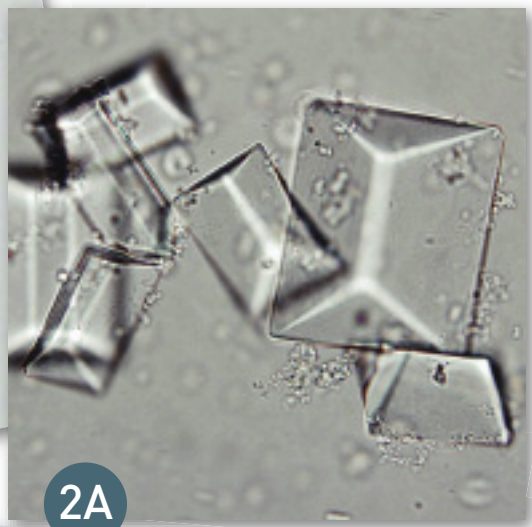
___ TALC GRANULES

___ STRUVITE CRYSTALS

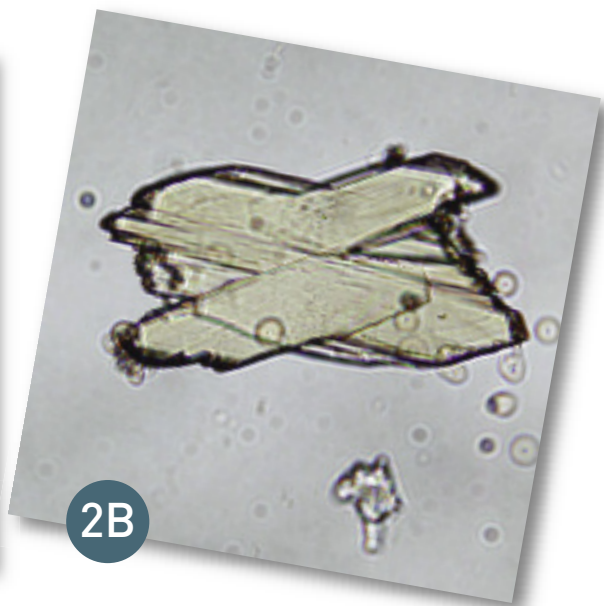




1B



2A



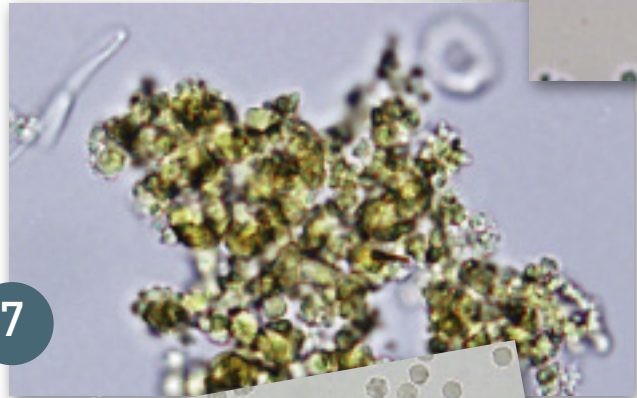
2B



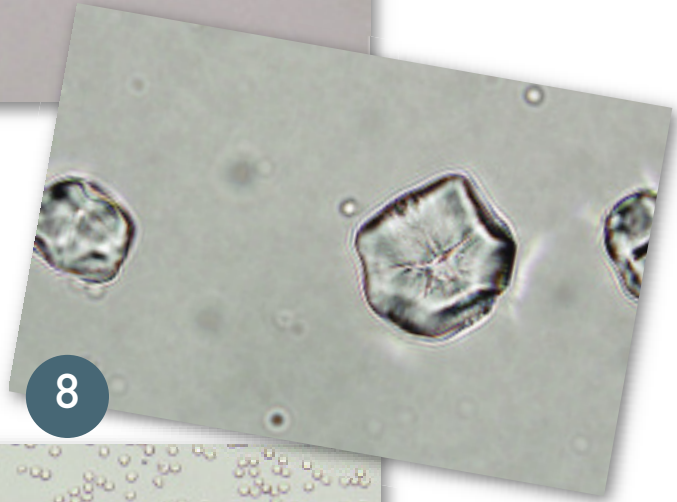
4



5



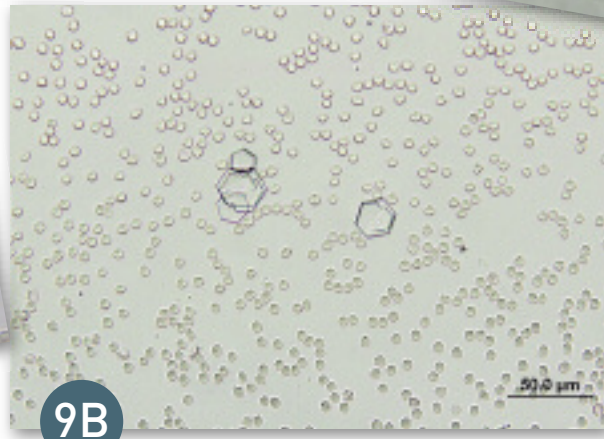
7



8

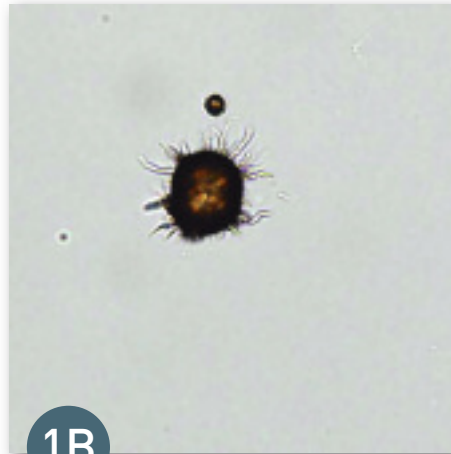
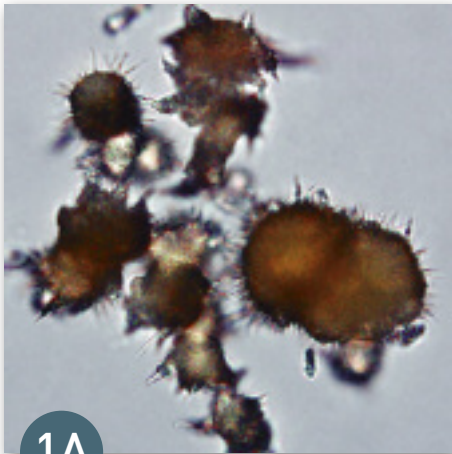


9A



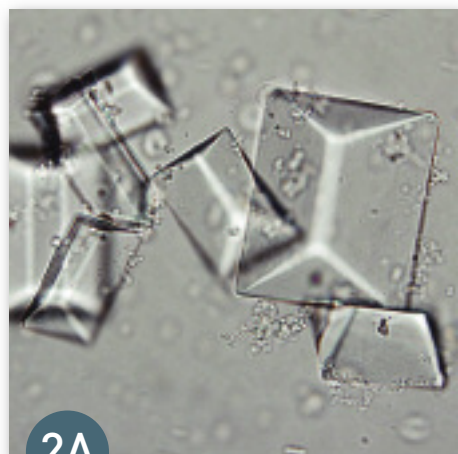
9B

CONTINUES



Ammonium biurate crystals appear as yellow to brown spherules with irregular projections (“thorn apple” or “sarcoptic mange” appearance). A smooth, spheroid form may also be seen. Crystals typically form as a result of liver disease or portal vascular anomalies. Decreased conversion of ammonia to urea results in hyperammonemia, and increased concentration of ammonia in the urine leads to crystal formation. These crystals may also be seen in animals with ammonium biurate urolithiasis. In general, they should be considered a pathologic crystal indicative of underlying hepatic disease; however, they may be seen in low numbers in clinically normal dalmatians and English bulldogs.

Calcium oxalate monohydrate crystals occur as colorless, flat, elongated crystals with pointed ends, which give them a “picket fence” appearance, or as spindle- or dumbbell-shaped crystals. The latter 2 shapes can also be formed by other calcium-containing crystals, such as calcium carbonate (not observed in dogs and cats). Calcium oxalate monohydrate crystalluria can be observed with acute ethylene glycol (antifreeze) toxicity; however, by the time animals present with clinical signs of acute renal failure, the crystals may no longer be detectable in the urine.



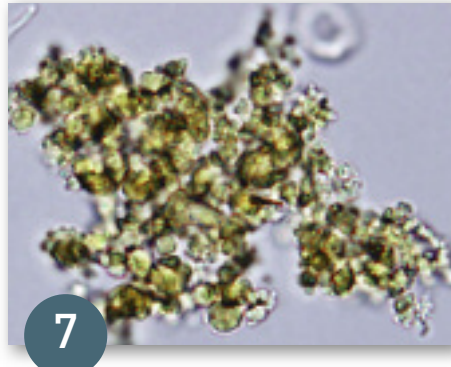
Struvite (magnesium ammonium phosphate) crystals are often found in the urine of normal dogs and occasionally in the urine of normal cats. The crystals typically appear as variably sized, colorless, rectangular (“casket cover” appearance) prisms (A). Struvite crystals can also form large, flat, square prisms or, uncommonly, X-shaped crystals (B). Struvite crystals usually form in alkaline urine, urine stored in the refrigerator, or urine left in an uncovered container at room temperature. They may be present in animals with uroliths or urinary tract infection (caused by urease-producing bacteria, which convert urea to ammonium). In cats, struvite crystalluria can occur in the absence of infection, likely due to ammonia excretion by the renal tubules.

Melamine cyanurate crystals are small, yellow to brown spheres with centrally radiating lines. These crystals have been associated with melamine- and cyanuric acid-tainted food. Although their morphology is similar to spherical calcium carbonate crystals and the spherical form of trimethoprim-sulfa crystals, they are significantly smaller in size.



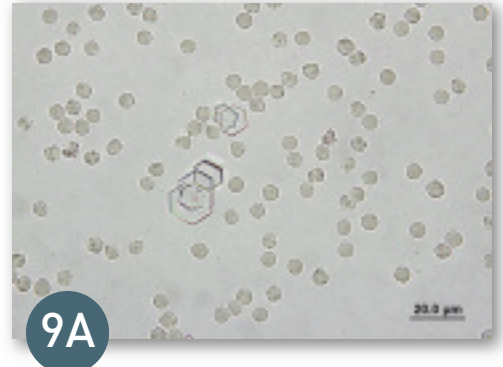
5

Bilirubin crystals appear as groups of golden spicules. They may be seen in highly concentrated urine from normal dogs, especially males. When present in high numbers in unconcentrated urine or in cats, these crystals suggest an abnormality in bilirubin metabolism due to either hemolysis or cholestatic disease (hepatic or posthepatic).

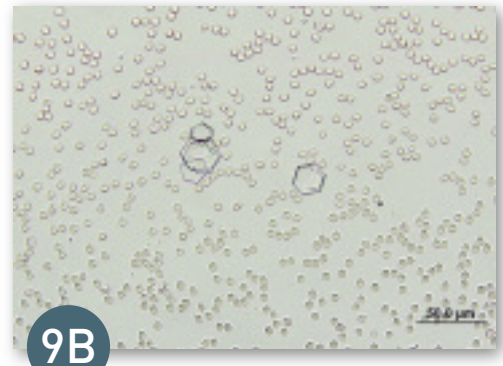


7

Hemoglobin precipitates appear as small, yellow to brown, variably sized, round to polygonal, refractile particles that resemble crystalline material. Hemoglobin precipitates can be present when there is overwhelming intravascular hemolysis (eg, zinc toxicosis). This is an uncommon finding, even in dogs with intravascular hemolysis, and should always be interpreted in light of other clinical findings. Amorphous phosphates and amorphous urates have a similar appearance and are encountered commonly. These typically have no significance.

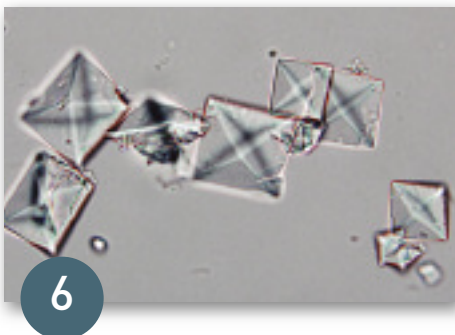


9A



9B

Cystine crystals are flat, hexagonal, colorless, variably-sized crystals that are often observed stacked together. These crystals are uncommon in dogs and rarely found in cats. Cystinuria is due to an inherited metabolic disorder involving defective amino acid transport across renal tubular cells, which causes a selective increase in renal clearance and urinary excretion of cystine. The crystals form due to high concentration of excreted cystine and decreased solubility in acidic urine. Not all dogs with cystinuria will form cystine crystals, but if observed, the crystals are diagnostic for cystinuria. Dogs with cystinuria are at risk for developing cystine uroliths. In cats, cystine crystals may be confused with some forms of struvite crystals that are flat and 6- to 8-sided.



6

Calcium oxalate dihydrate crystals appear as colorless squares with intersecting diagonal lines ("envelope" or "Maltese cross" appearance). They often occur in acidic urine or in urine that has been stored either at room temperature or in the refrigerator. Calcium oxalate dihydrate crystalluria is seen in animals with enhanced urinary oxalate excretion after ingestion of oxalate-rich plants or plant-based foods, those with enhanced urinary calcium excretion due to hyperadrenocorticism or hypercalcemia, those treated with urinary acidifiers, and those with certain urinary tract infections or uroliths. They can also be seen in clinically normal animals.



8

Talc granules may be observed when powdered gloves are used to handle the sample. They are variably sized, round with irregular borders, and often contain central cruciform lines. Talc granules, glass chips, and plant pollen are common crystal-like contaminants of urine samples, and may be mistaken for urine crystals.

Article archived on cliniciansbrief.com