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Program for Smådyr

Renal disease – interpretation of blood & urine test results

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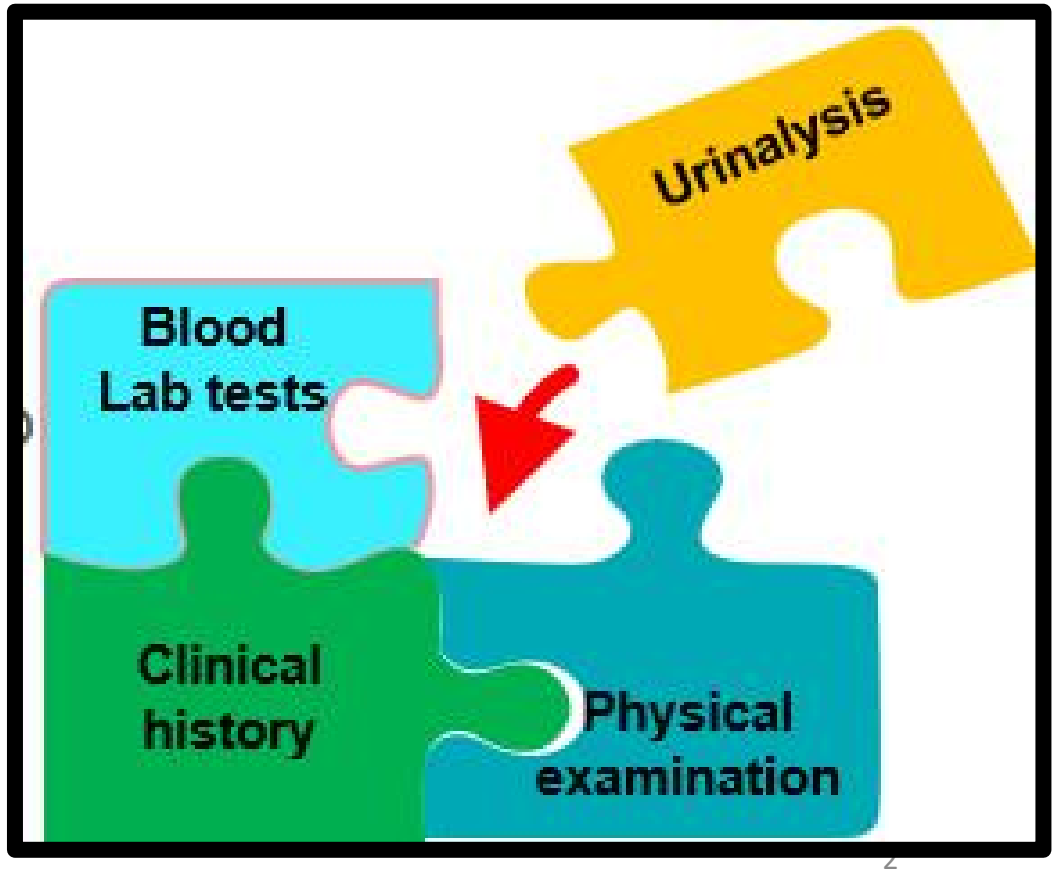
Content

- **Renal disease**
  - Clinical presentation
- **Laboratory tests**
  - Azotaemia – SDMA
  - Urine specific gravity (USG)
  - Urinalysis
- **Interpretation of results**
  - Azotaemia, SDMA and USG
- **Cases - Quiz**



Renal Disease Is Common

- *But* some extra-renal diseases can
  - have similar clinical history and physical examination findings.
  - impair renal function.

Renal Disease

CLINICAL HISTORY

- Polyuria -Polydipsia
- Reduced appetite
- Weight loss
- Other signs
  - vomiting/diarrhoea
  - lethargy
  - incontinence
  - weakness
  - halitosis

PHYSICAL EXAMINATION

- Dehydration
- Gingivo-stomatitis/ulceration
- Poor body condition
- Pallor (= anaemia)
- Weakness including cervical ventroflexion (= hypokalaemia)
- End organ damage e.g.blindness, hyphaema, neurological abnormalities (= hypertension)

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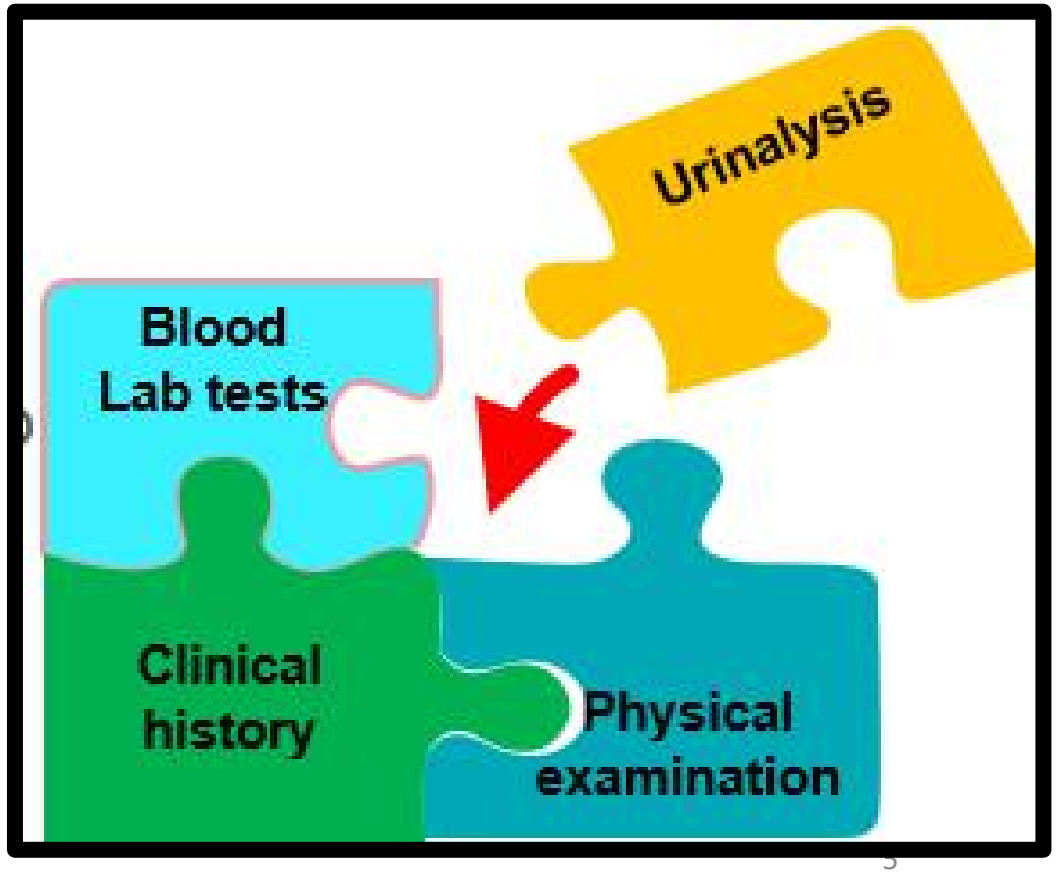


Renal disease in the DDx list: First line Laboratory tests

BLOOD sample

- Haematology
- Biochemistry
  - UREA
  - CREATININE
  - SDMA
  - PHOSPHATE
  - CALCIUM
  - POTASSIUM

+

URINE sample

- SPECIFIC GRAVITY (USG)
- PROTEIN:CREATININE RATIO (UPC)
- MICROSCOPY (Sediment-Cytology)

AZOTAEMIA (Laboratory finding)

URAEMIA (Clinical syndrome)

- Increased concentrations of non-protein nitrogenous wastes
  - Increased UREA
  - Increased UREA+CREAT
- *Urea decreases*
  - *Hepatic dysfunction*
- *Creatinine decreases*
  - *Loss of body mass*

PRERENAL azotaemia

HYPOVOLAEMIA (UREA±CREAT)

DEHYDRATION (UREA±CREAT)

Large meat meal (UREA only)

GI Haemorrhage (UREA only)

RENAL azotaemia

Due to impaired renal function (UREA+CREAT)

- **Primary intra-renal disease**

≥ 75% of nephrons have lost their function

POSTRENAL azotaemia

Due to urinary tract obstruction or rupture resulting in accumulation of urine in the body (UREA+CREAT)

SDMA

- SDMA concentration *increases earlier in chronic kidney disease* than CREAT.
- SDMA does not decrease with loss of body mass
  - More sensitive indicator of kidney function in patients with muscle loss than CREAT.
- SDMA can increase with neoplasia (without concurrent renal disease).

PRERENAL

HYPOVOLAEMIA

DEHYDRATION

RENAL

Due to impaired renal function

- **Primary intra-renal disease**

≥ 40% of nephrons have lost their function

POSTRENAL

Due to urinary tract obstruction or rupture resulting in accumulation of urine in the body

URINE SPECIFIC GRAVITY

- Measured with the refractometer
- Density of urine compared to water
- Renal function test)
  - Concentrating ability of the nephrons

- Hyposthenuria [USG < 1.008 (Dog), USG < 1.006 (Cat)]
  - USG is lower than the specific gravity of the glomerular filtrate (GF)
  - Urine has been actively diluted
- Isosthenuria (USG 1.008 - 1.012)
  - USG is similar to the specific gravity of the GF
  - Urine has neither been diluted nor concentrated
- Hypersthenuria (USG > 1.012)
  - USG is higher than the specific gravity of the glomerular filtrate (GF)
  - Urine has been concentrated to some degree.
  - Whether the degree of concentration is appropriate or not must be determined for the patient's clinical condition
    - Dehydrated animals with normal renal function
      - Appropriate: USG > 1.030 (Dog), USG > 1.035 (Cat) – Most commonly USG > 1.045

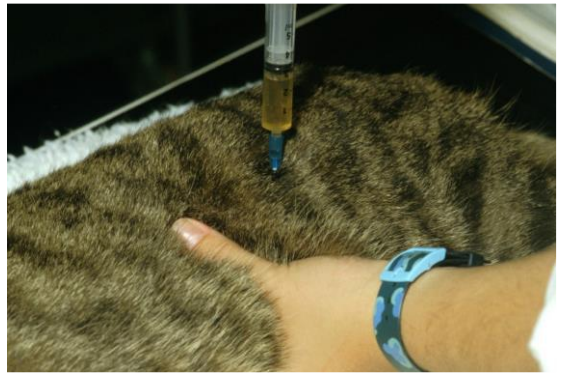
- USG decreases **before** the development of azotaemia
- USG falls into the **isosthenuric** range
  - once **65% of RENAL FUNCTION HAS BEEN LOST**

IRIS International Renal Interest Society

Take home points

- Azotaemia has always to be interpreted in conjunction with the USG
- **UREA, CREAT and USG**
  - **Are not sensitive** markers of Renal dz
    - **Azotaemia** occurs after >75% of nephrons have been lost.
    - **Isosthenuria** develops once 65% of renal function is lost.
  - **Are not specific markers** of Renal dz because are affected by non-renal factors
    - UREA affected by dehydration, high protein diet and hepatic dz
    - CREAT impacted by muscle mass
    - USG affected by hydration status and extra-renal dz affecting renal concentrating ability
- **SDMA**
  - More sensitive marker of Renal dz
    - Increases after >40% of renal function is lost
  - SDMA not impacted by muscle mass
- **Measuring CREAT and SDMA over a period of time** and looking for increasing trends is **more useful** than compering results to the values of the reference interval
    - Renal dz can be present even when values are within normal limits
- **Concurrent measurement of CREAT and SDMA** identifies more animals with impaired renal function than measuring only CREAT or only SDMA

Urinalysis

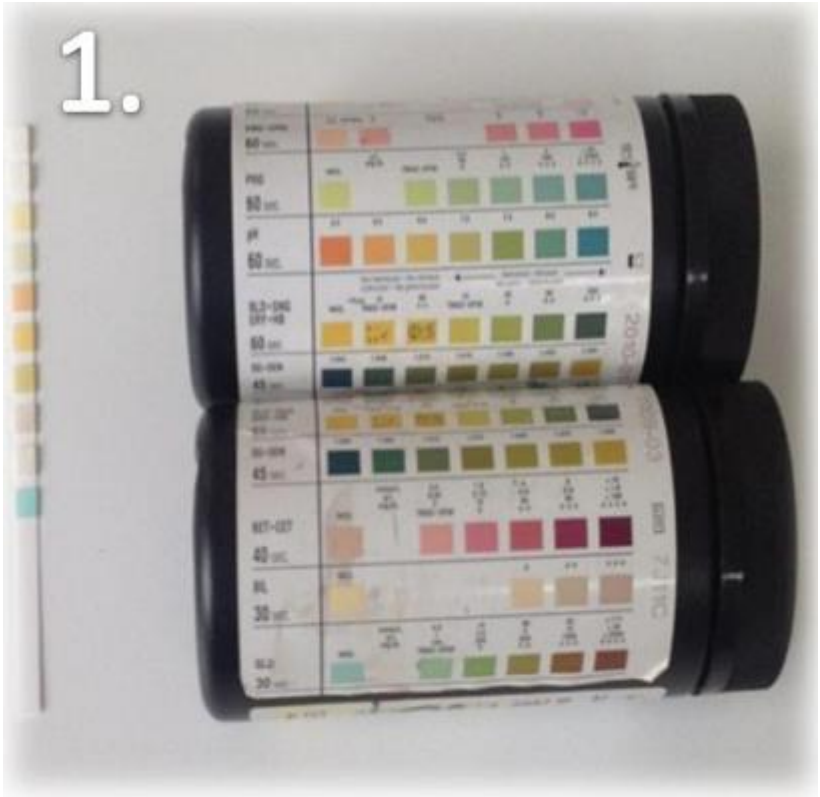


- Is best preformed in-clinic and **ideally within 1 hour** of collection.
  - As a urine sample “ages”
    - casts and cells degrade
    - bacteria tend to multiply leading to changes in the pH
    - crystals may either sediment or dissolve

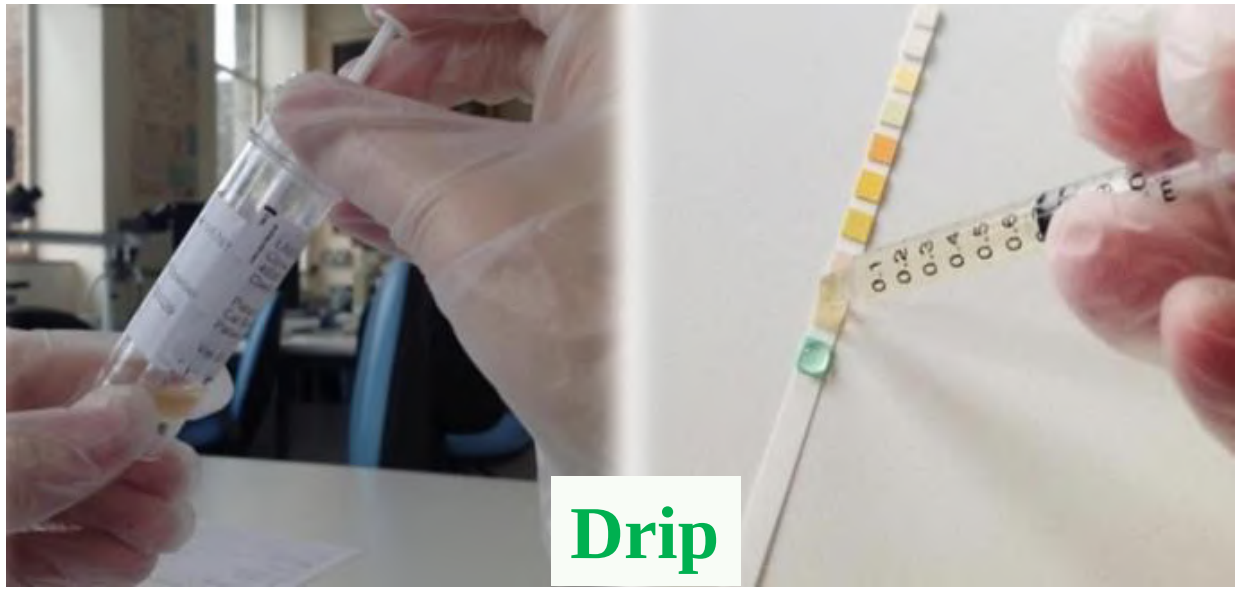
- If this is not possible, **refrigeration** is recommended
  - **ideally for less than 6 hours** (no more than 12 hours)

- Allow the sample to return to room temperature and mix it well.

- Refrigeration tends to **increase the number of crystals** present particularly for Calcium oxalate.



Dipsticks commonly include tests for specific gravity, pH, glucose, protein, blood, bilirubin, ketones, urobilinogen, nitrite, and leukocytes.



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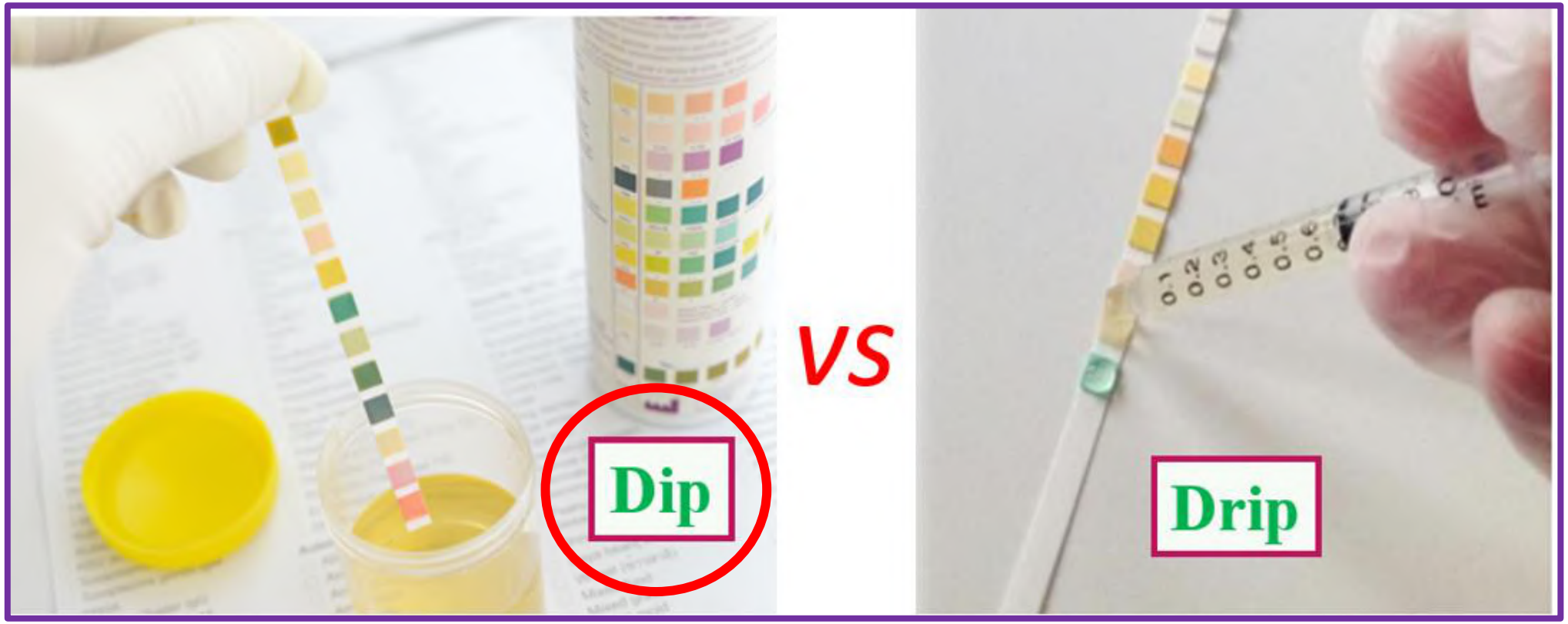
BRIEF COMMUNICATION

WILEY Veterinary Clinical Pathology
An International Journal of Laboratory Medicine

Evaluation of the effect of urine dip vs urine drip on multi-test strip results

Alisdair M. Boag | Craig Breheny | Ian Handel | Adam G. Gow

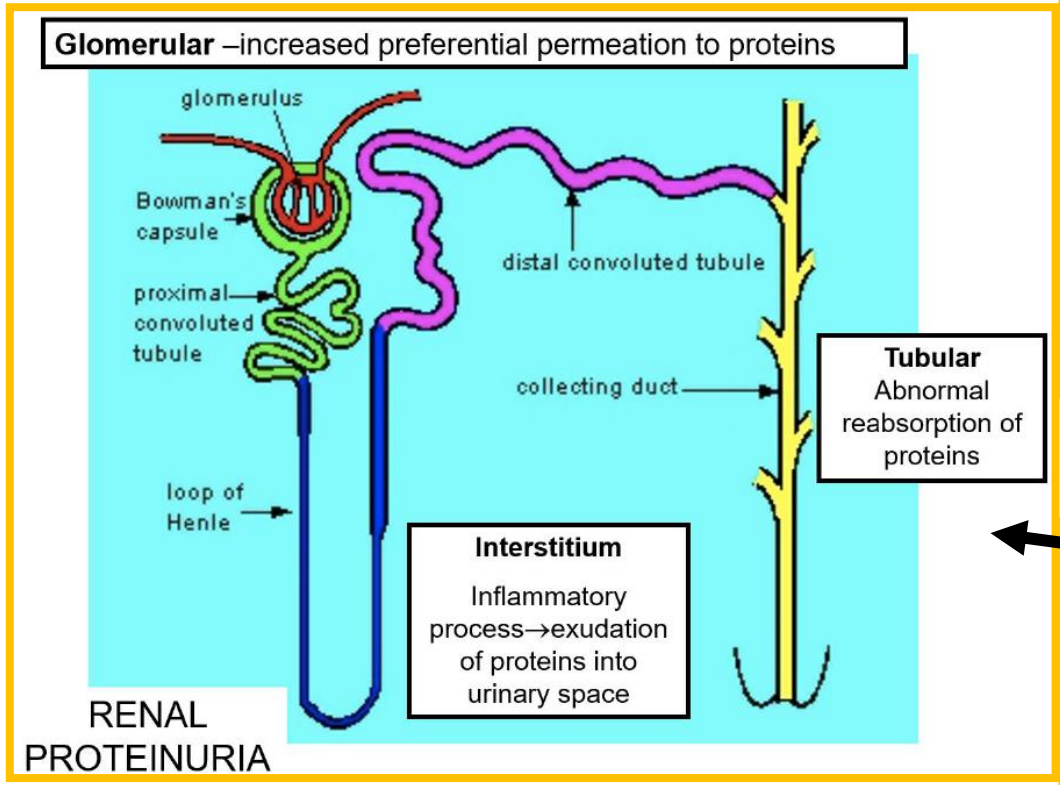
- Clinically different results especially with Blood and pH tests
- More Glucose false positives with Drip
- When sample volume permits, Dip is recommended



Urine dipsticks

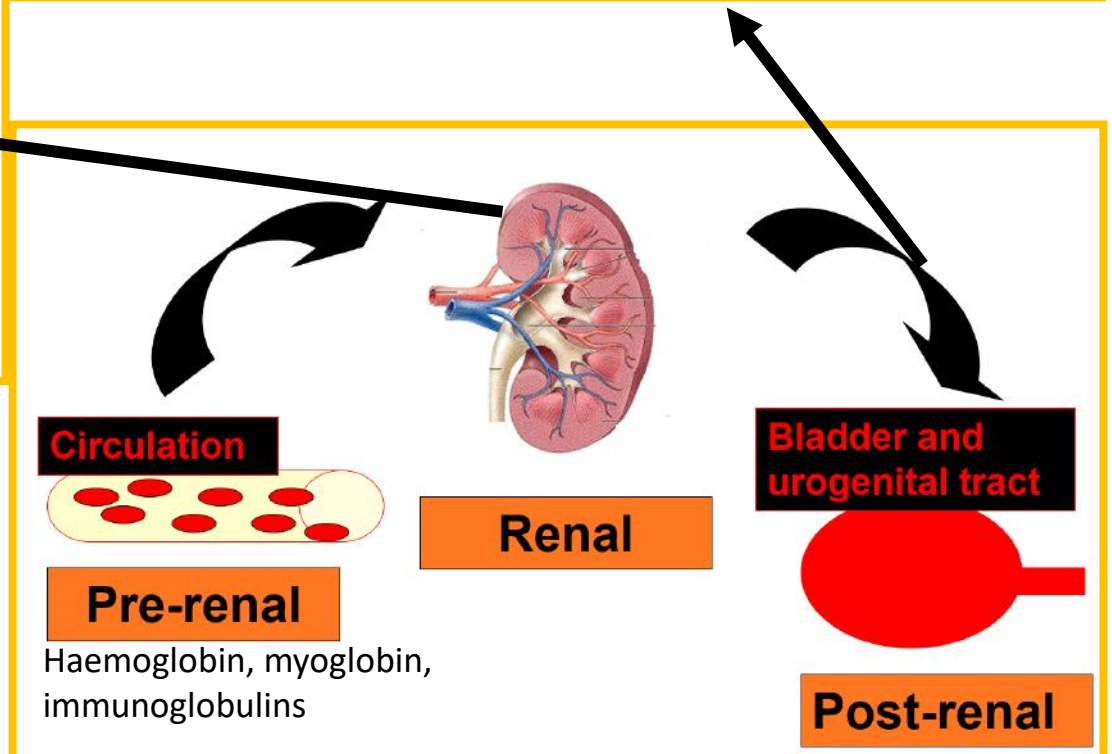
- Almost all diagnostic strips have been designed for human use
- Reliable tests for dogs & cats
  - Glucose, *Bilirubin*, Protein, Blood, Ketones, pH
- Unreliable tests for dogs & cats
  - Urobilinogen, Nitrite, Leukocytes, SPECIFIC GRAVITY

Proteinuria - UPC

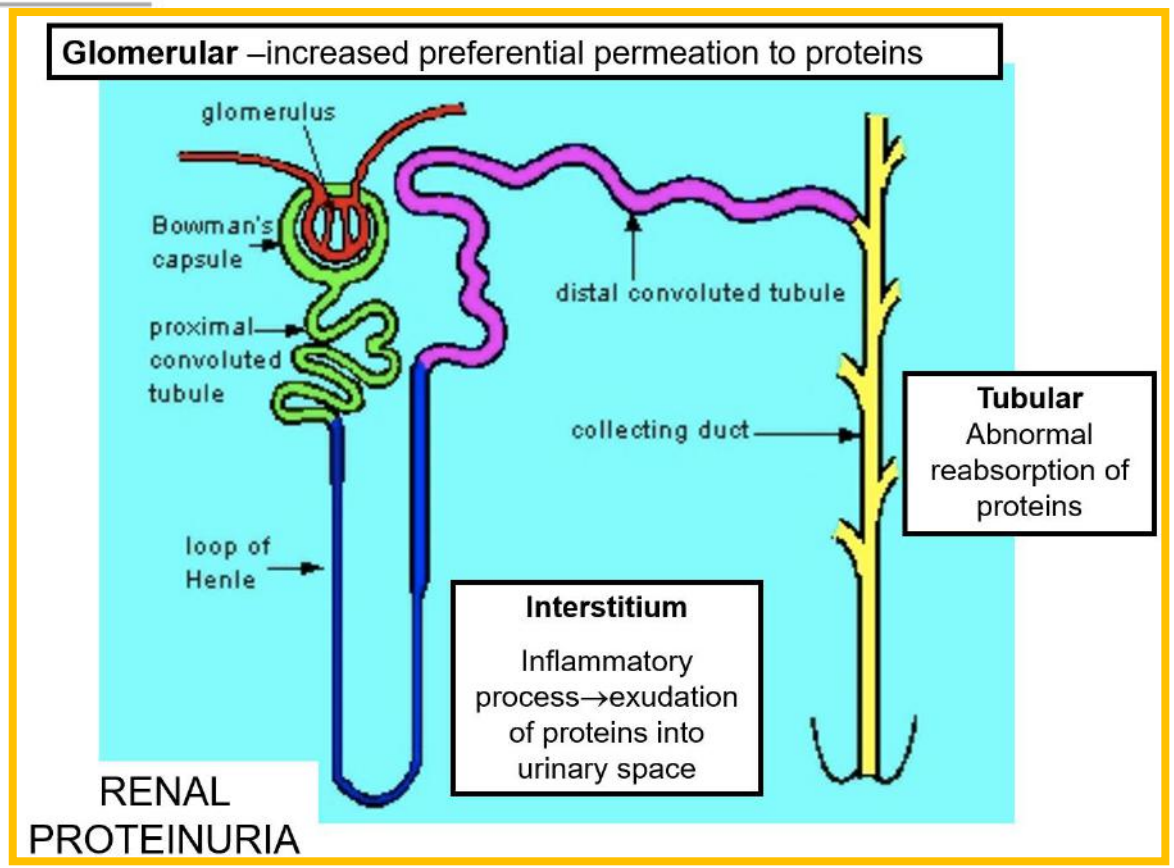


Post-renal proteinuria

- Protein enters urine after urine has left renal pelvis
  - Urinary tract in origin
    - Haemorrhage or exudation
      - Ureters, bladder, urethra
  - Extra-urinary in origin
    - Proteins from secretions, haemorrhage or exudation in the genital tract or external genitalia



	Dog	Cat
Non-proteinuric	< 0.2	< 0.2
Borderline Proteinuric	0.2 to 0.5	0.2 to 0.4
Overtly Proteinuric	> 0.5	> 0.4



Persistent UPC >0.4/0.5 but <2.0 = tubular or mild glomerular disease

Persistent UPC >2.0 =

glomerular disease

SEDIMENT EXAMINATION: FINDINGS

- CELLS
- Creatures [bacteria, parasites (rare)]

- CASTS

- CRYSTALS

Red and White blood cells

- RED BLOOD CELLS
- can occur in clinically healthy animals
  - 4-5 cells/x40 objective

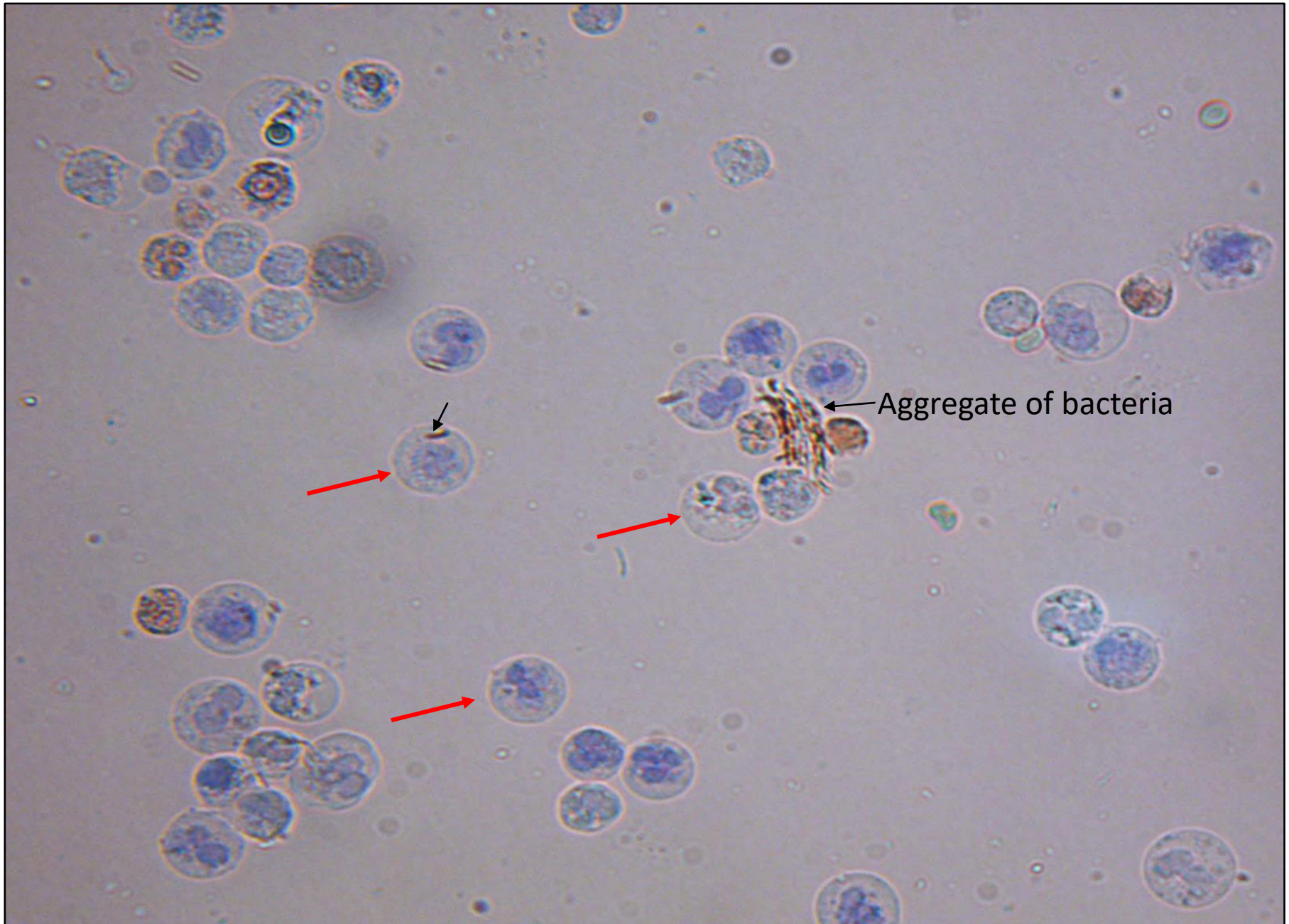
- HAEMATURIA/
- Haemorrhage
  - Urogenital disease
  - Clotting disorder

- WHITE BLOOD CELLS
- can occur in clinically healthy animals
  - 5-8 cells/x40 objective

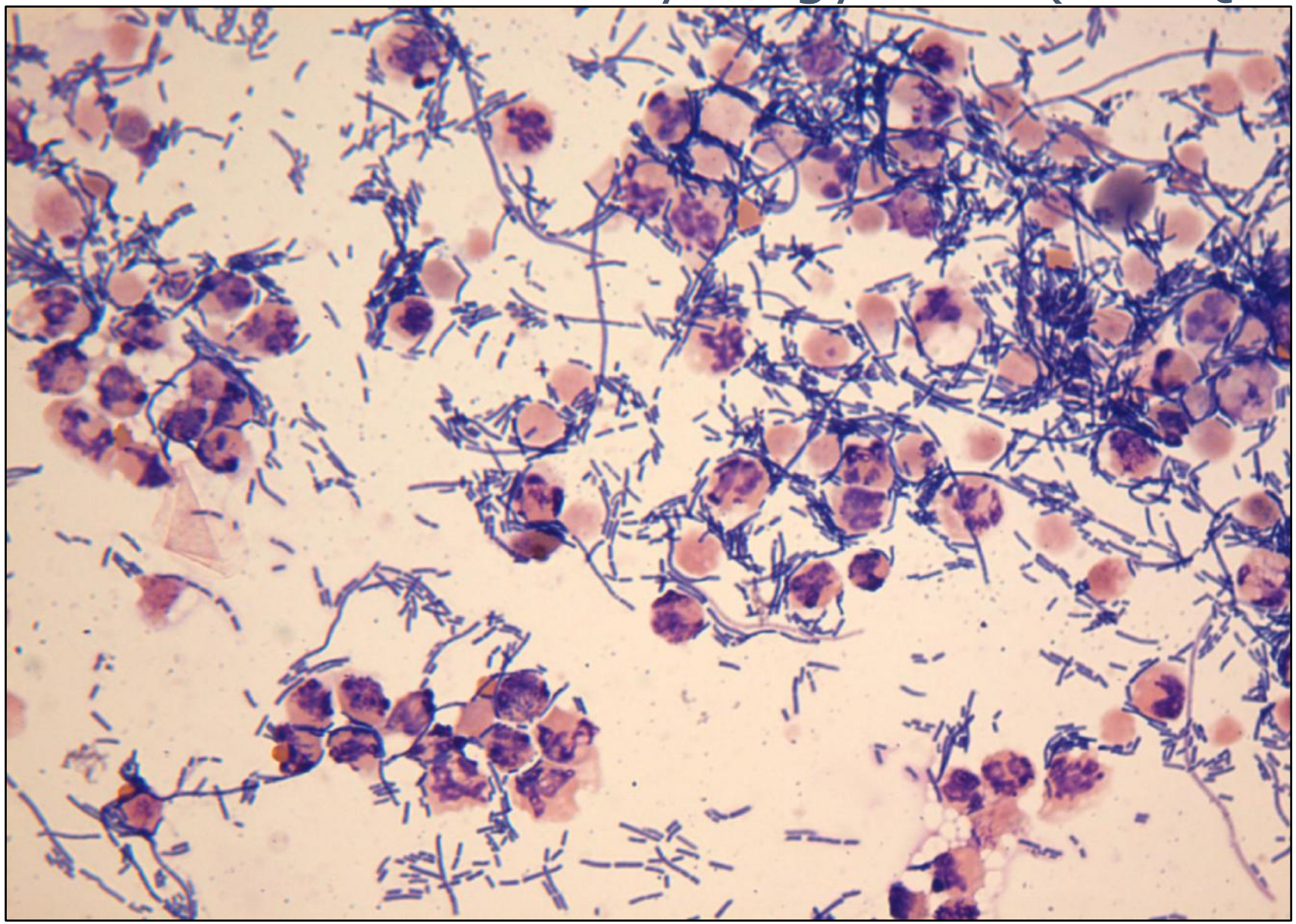
- Increases:
  - Inflammation
  - Infection

WBCs & RBCs

WBCs and bacteria [stained sediment with urine stain (Sedistain)]

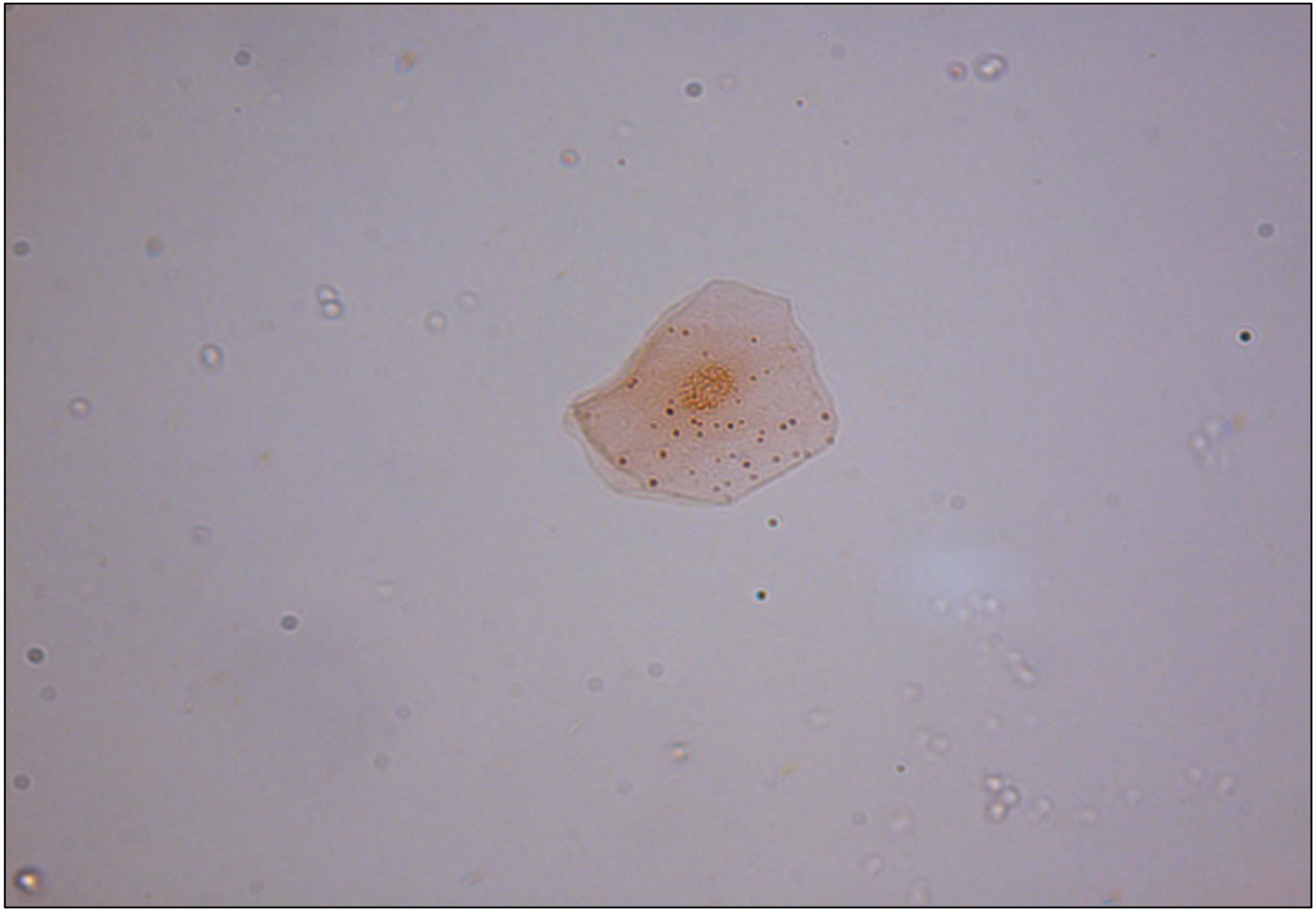


URINE SEDIMENT stained with cytology stain (Diff-Quik)

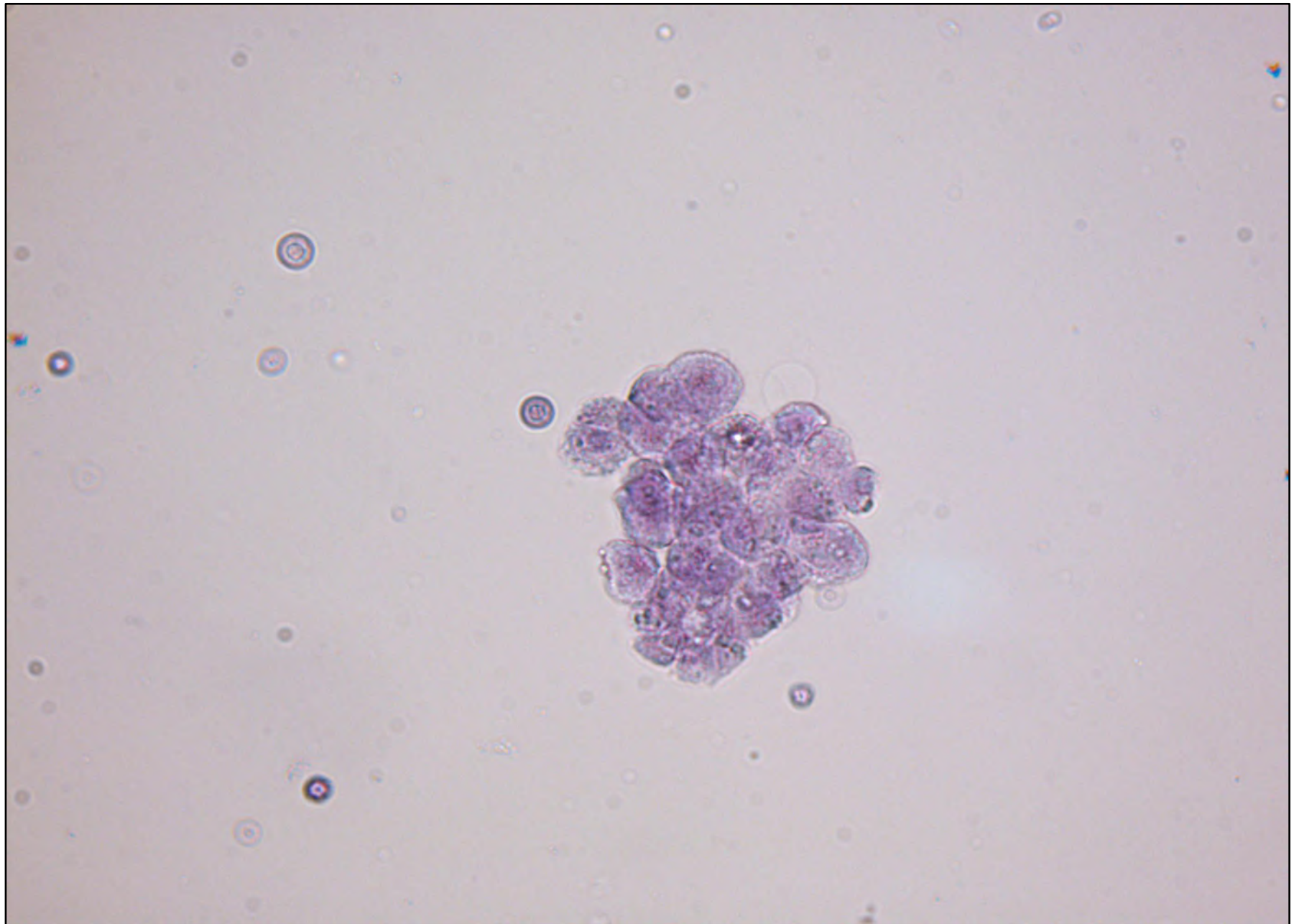


WBCs ***Bacteria (stained)***

Squamous epithelial cell [stained sediment with urine stain (Sedistain)]

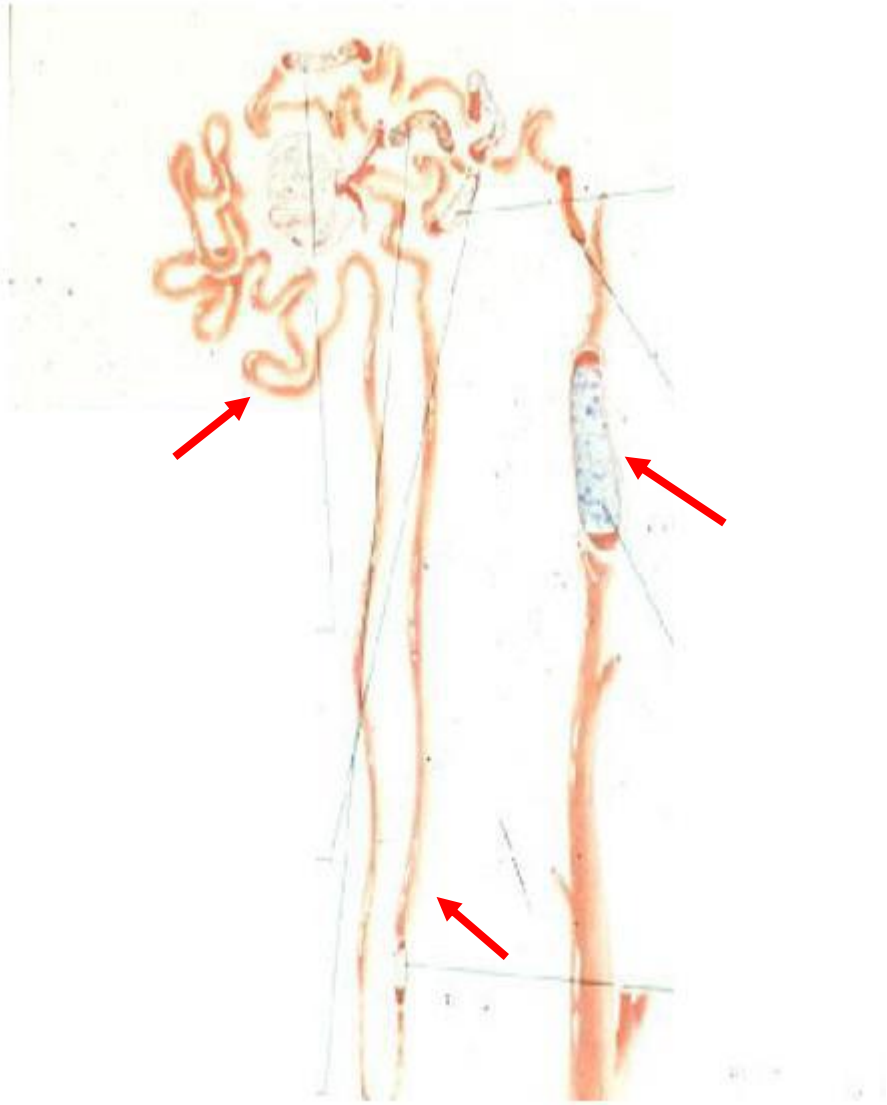


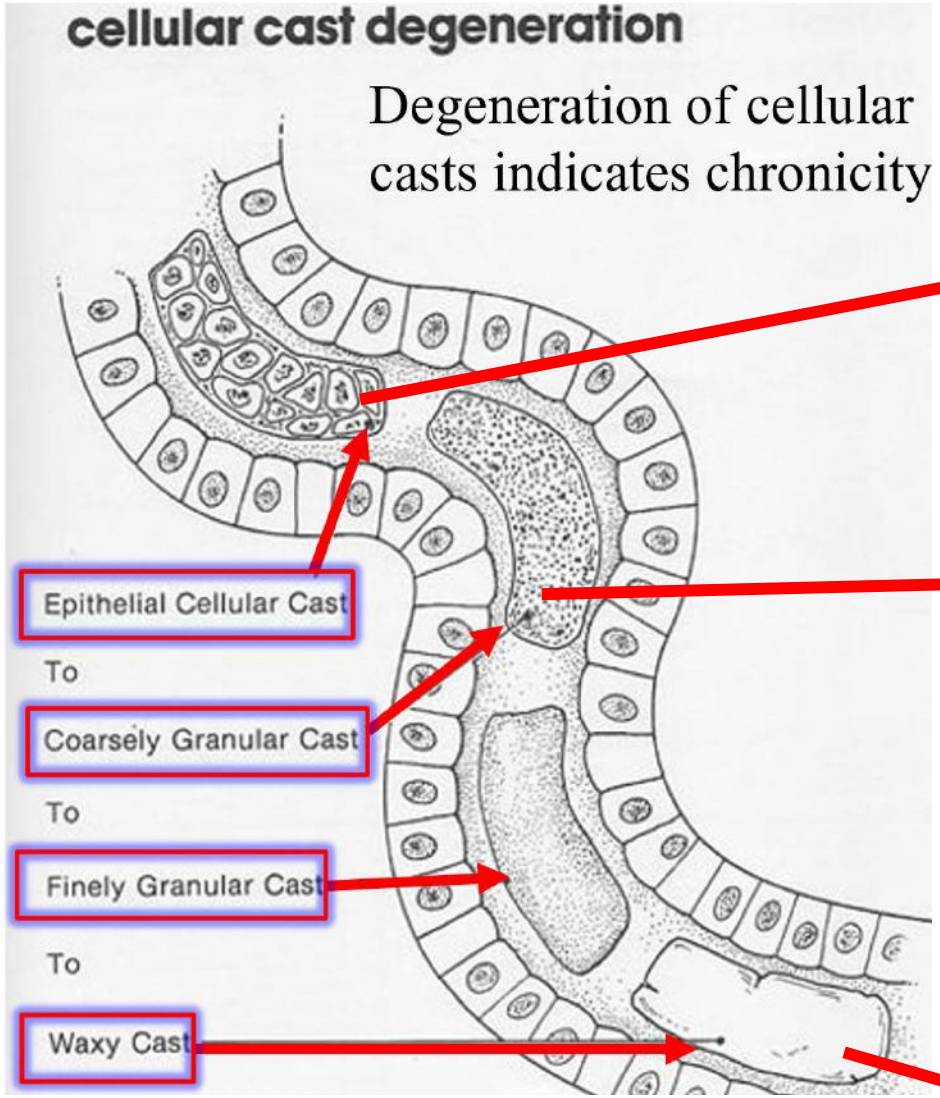
Transitional epithelial cells [stained sediment with urine stain (Sedistain)]

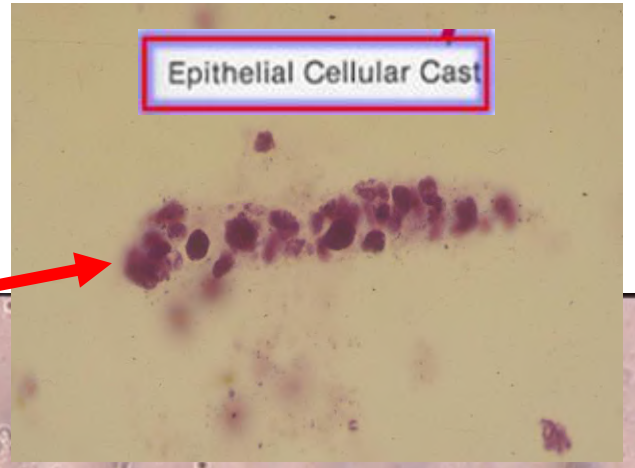


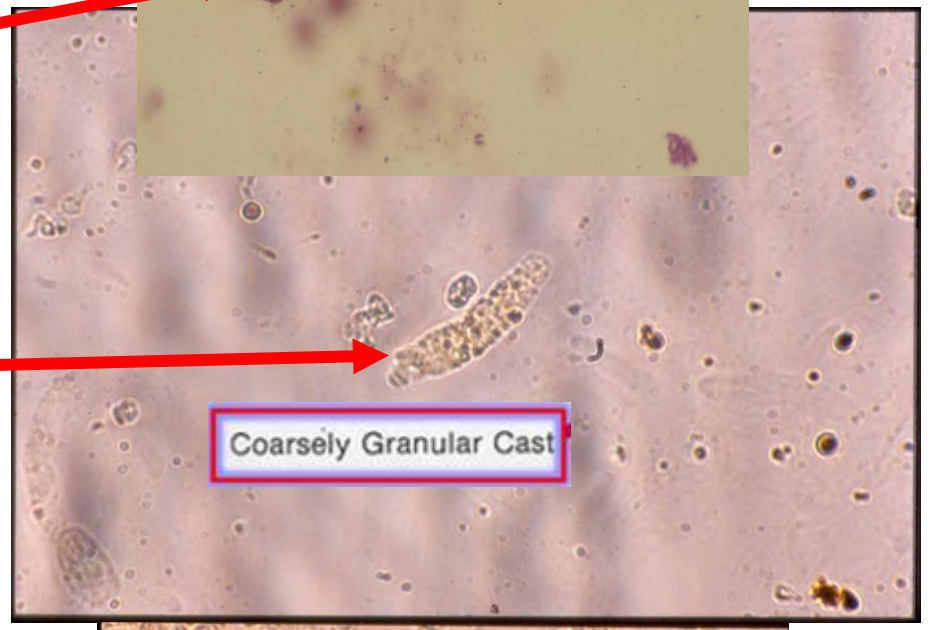
CASTS

- Cylindrical-shaped structures formed in the **tubules**
- healthy animals
  - <1 per x20 lens
  - more can be detected in old age.
- **High numbers indicate active Renal disease**




cellular cast degeneration
Degeneration of cellular casts indicates chronicity
Epithelial Cellular Cast
To
Coarsely Granular Cast
To
Finely Granular Cast
To
Waxy Cast


Epithelial Cellular Cast


Coarsely Granular Cast

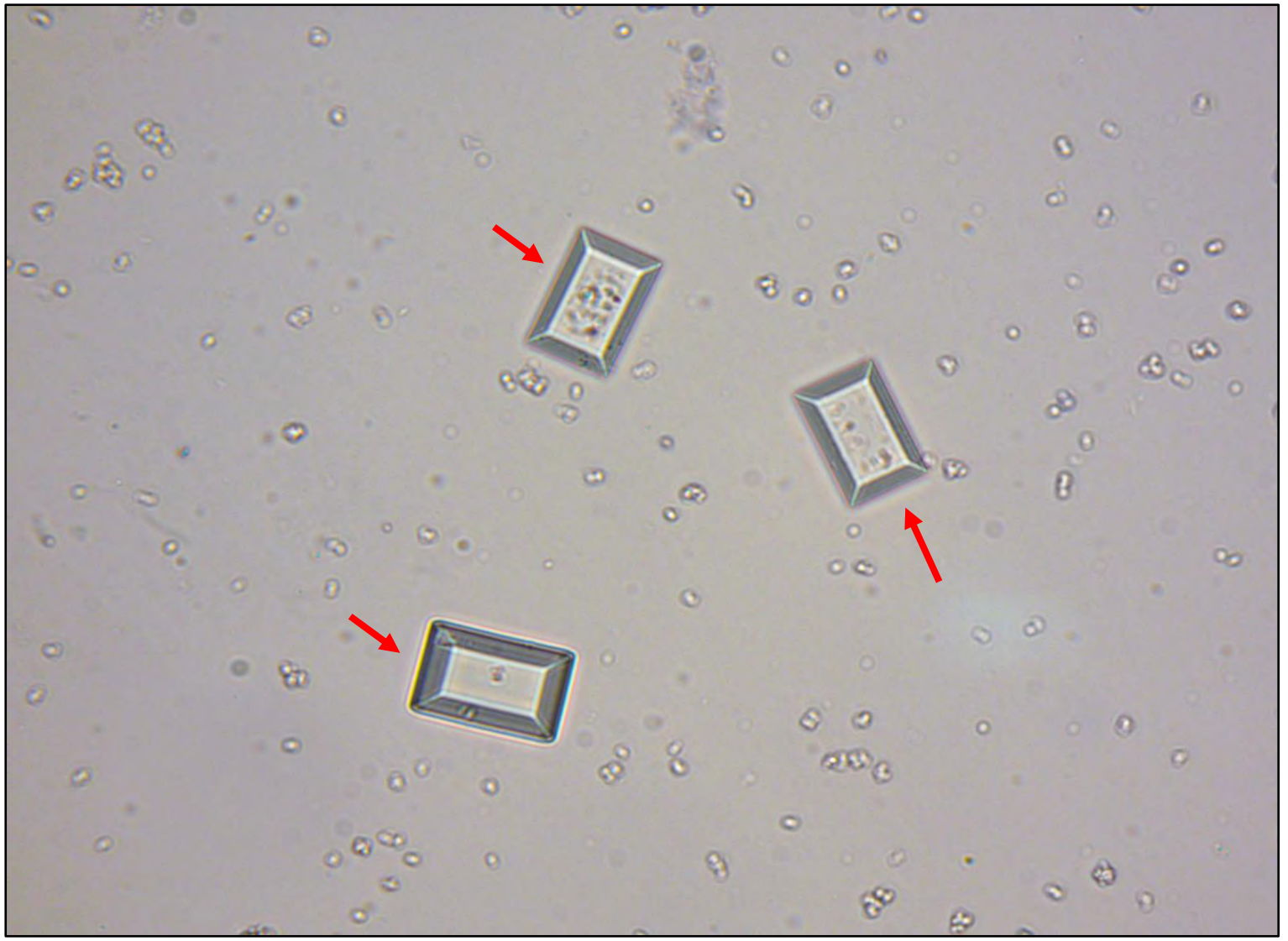

Waxy Cast

CRYSTALS

- Their formation is influenced by:
  - urine pH, solubility, medications
- Commonly found crystals in healthy animals:
  - Struvites
  - Calcium oxalate dihydrate
- Number and type of crystals is important to assess clinical significance
  - Struvite, Calcium oxalate dihydrate (in high numbers >>> uroliths)
  - Calcium oxalate monohydrate (=Ethylene glycol toxicity)
  - Ammonium urate (=Liver disease, Portosystemic shunt)

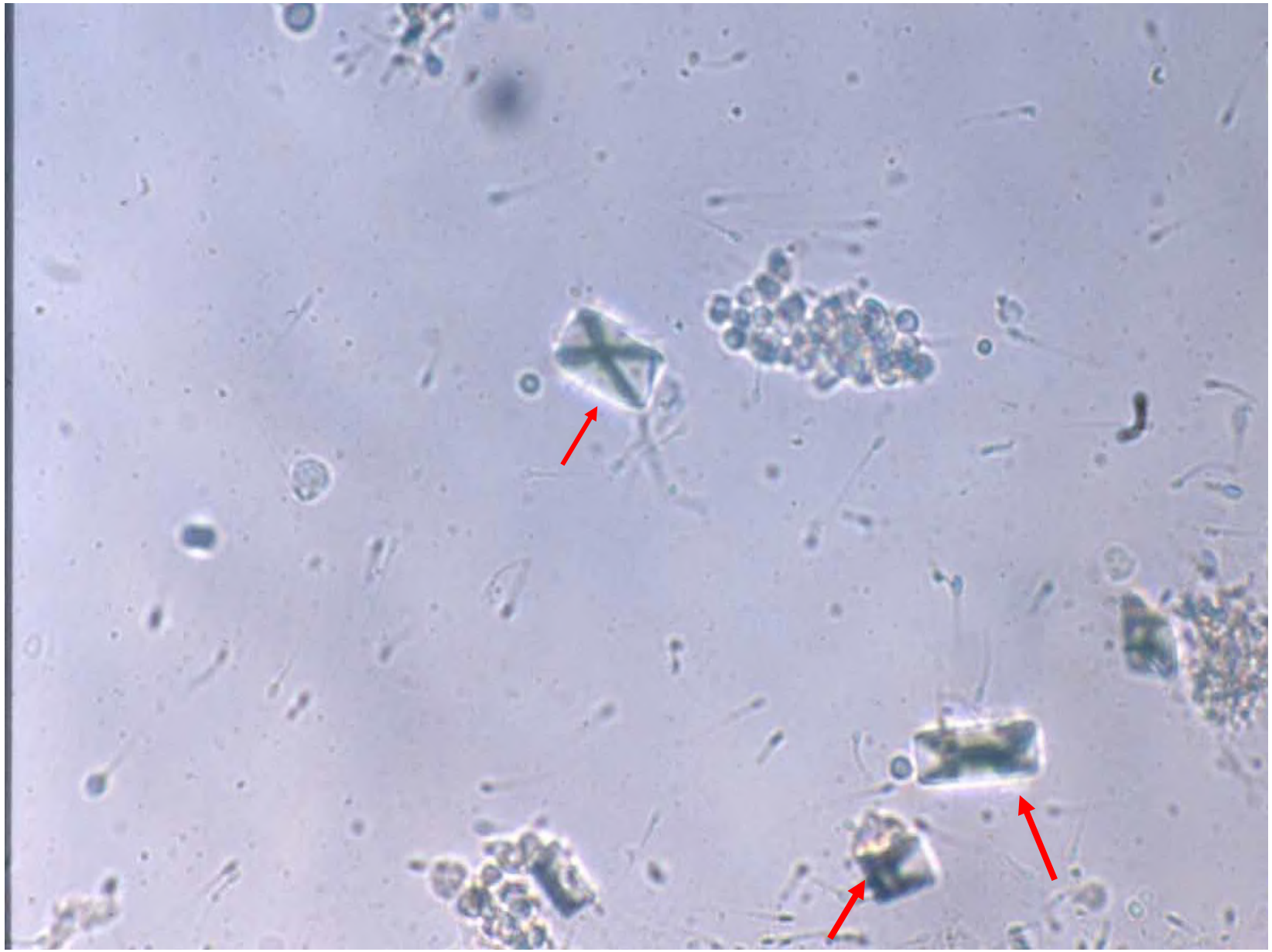
Struvites (magnesium ammonium phosphate)

- Alkaline/neutral urine
- Can be found in urine of healthy animals
- In high numbers,
  - common in urinary tract infections.



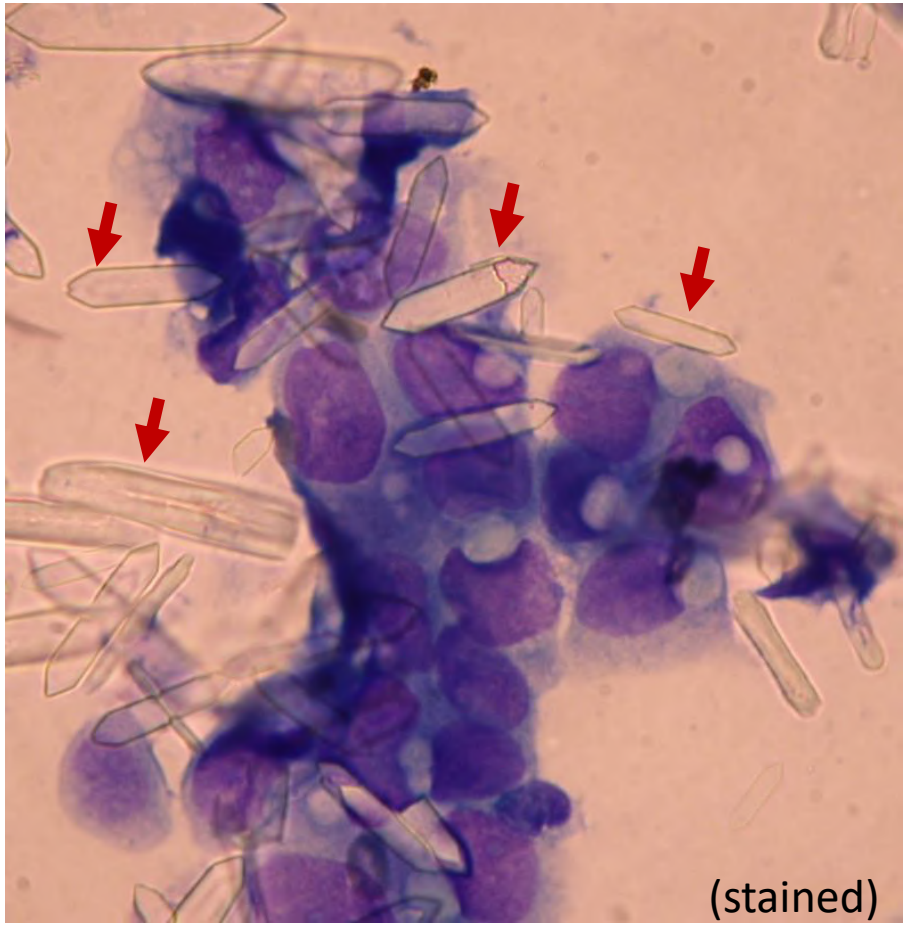
Calcium-oxalate dihydrate crystals

- Neutral/Acidic urine
- More common
  - in cats



Calcium-oxalate monohydrate crystals

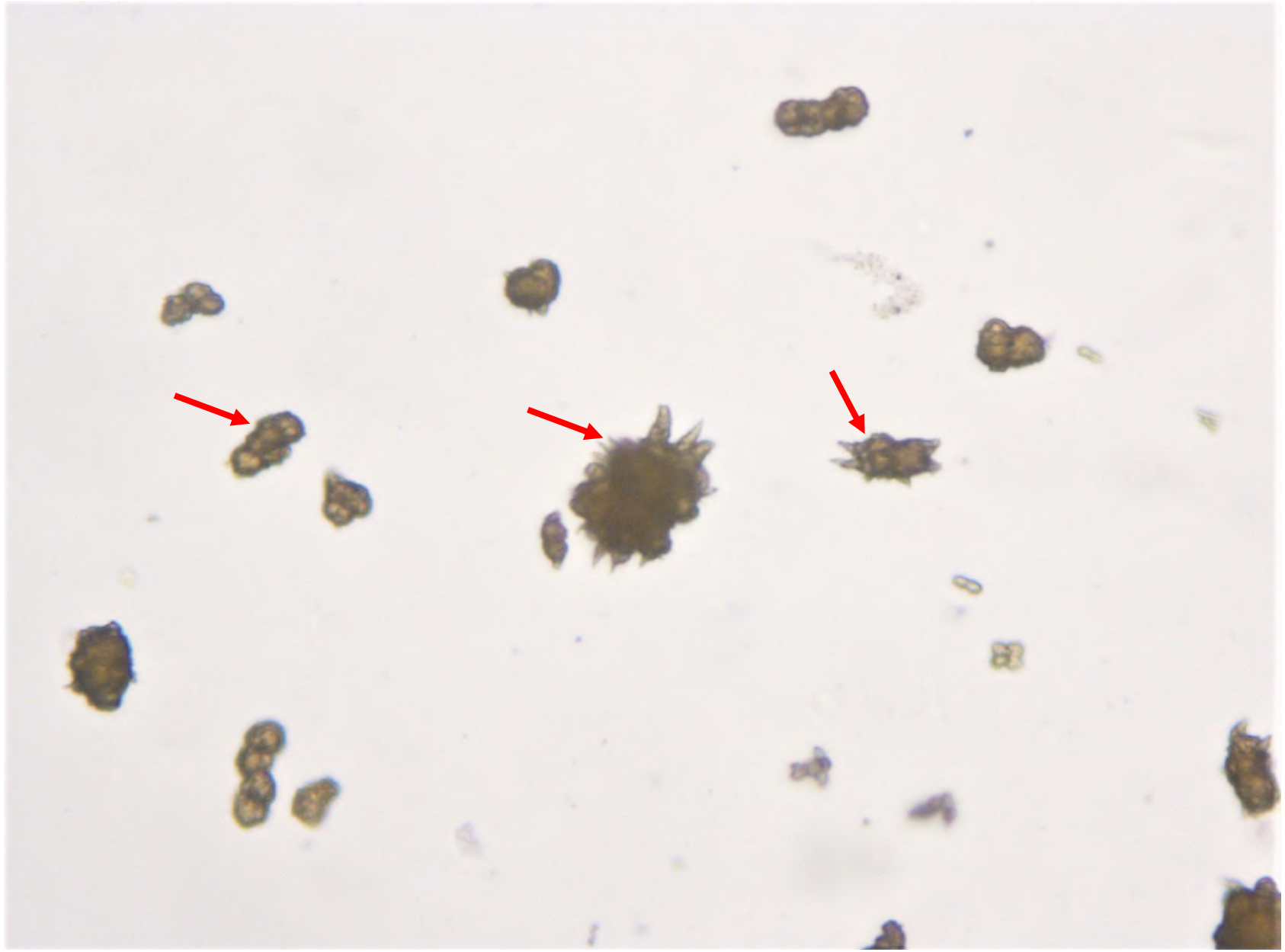
- Found in cases of ethylene glycol toxicity
  - Anti-freezer poisoning


(stained)

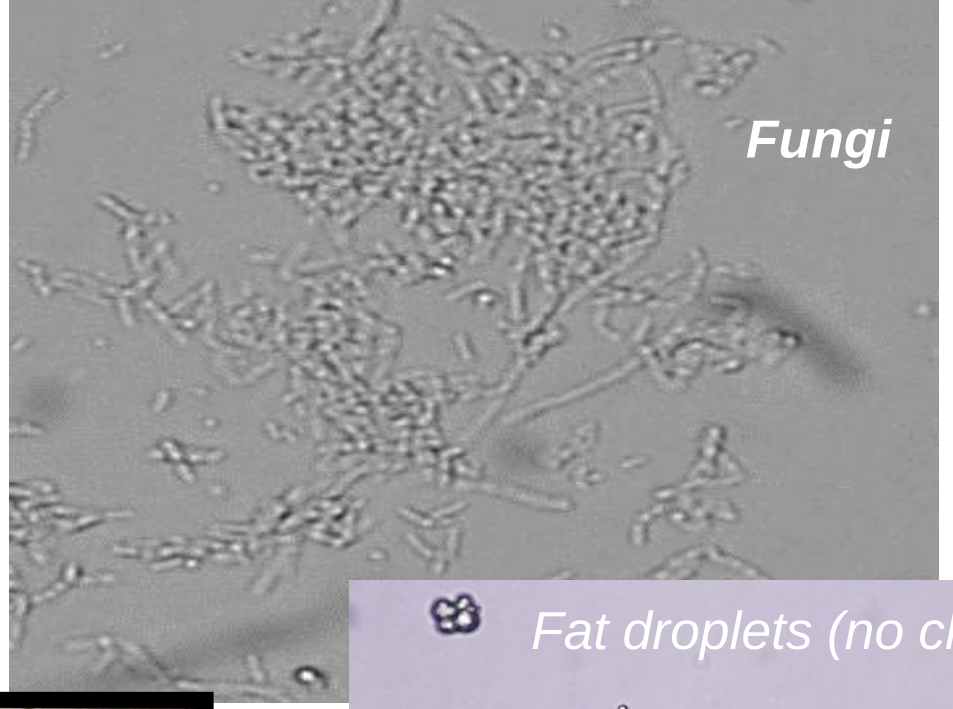
(not stained)

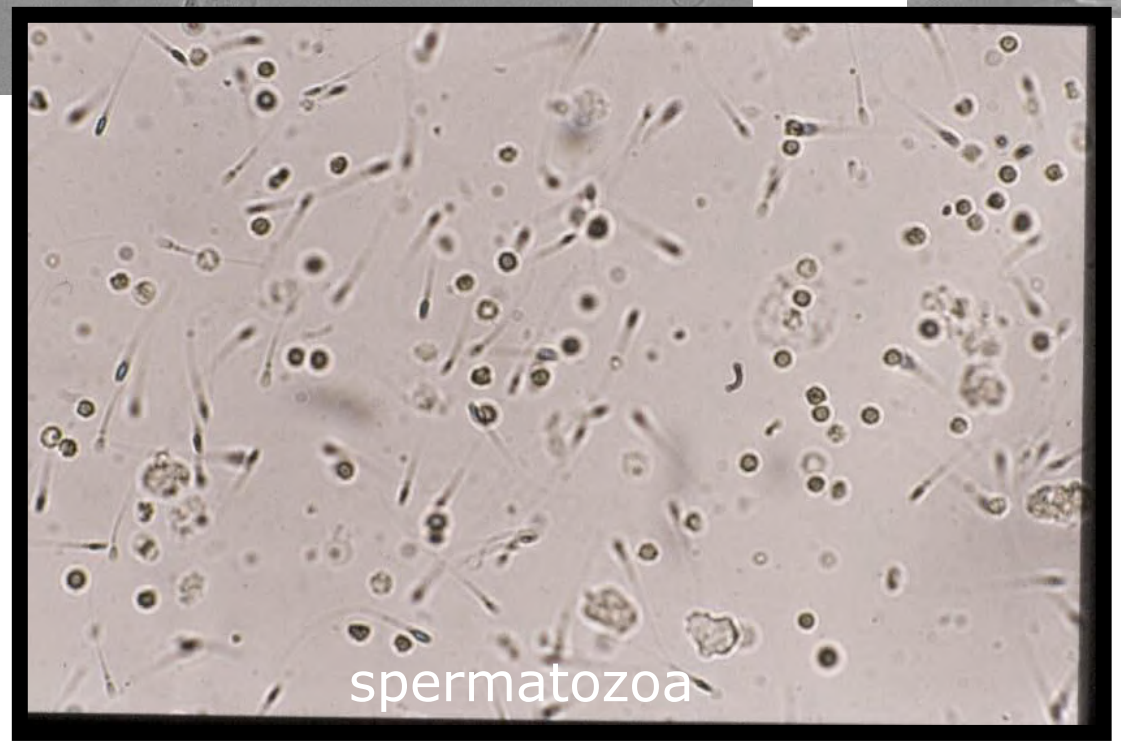
Ammonium urate crystals

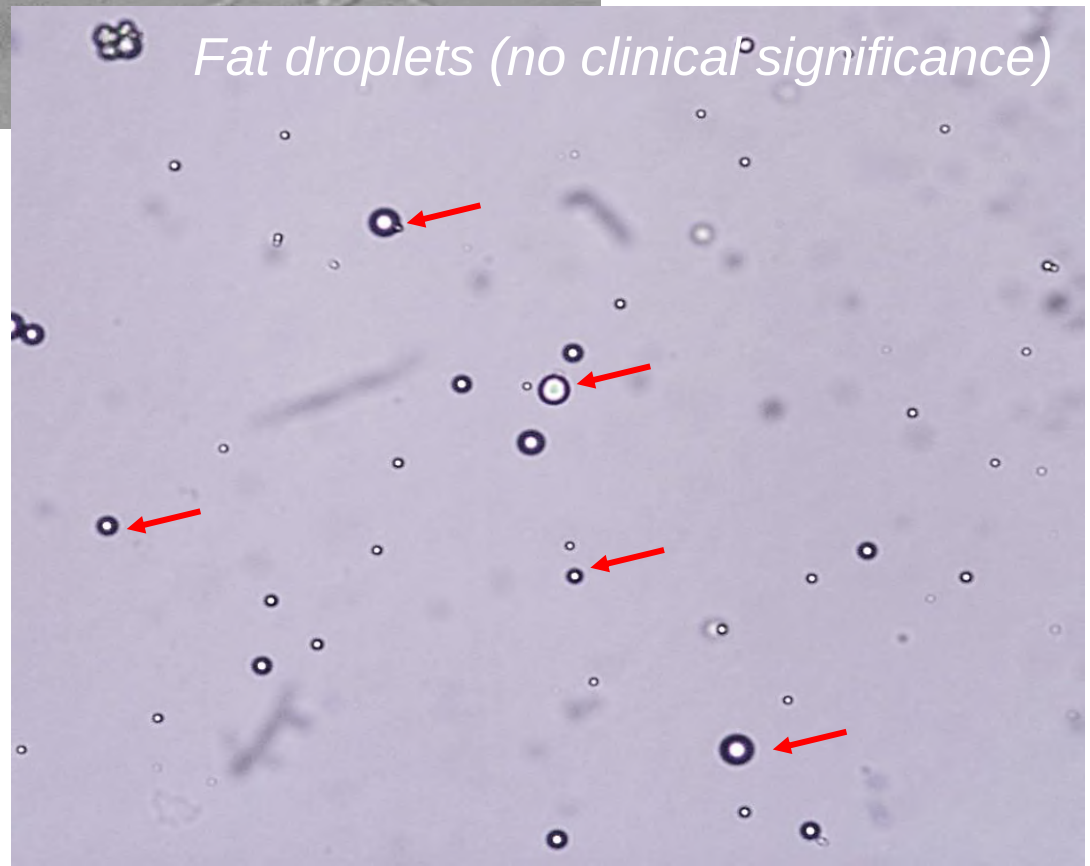
- Normal finding in healthy
  - Dalmatians
  - English Bulldogs
  - Reptiles, birds
- Found in cases of
  - Liver disease
  - Portosystemic shunts



OTHER FINDINGS







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Journal of Veterinary Internal Medicine ACVIM Open Access
American College of Veterinary Internal Medicine
STANDARD ARTICLE

Comparison of the performance of the IDEXX SediVue Dx® with manual microscopy for the detection of cells and 2 crystal types in canine and feline urine

Annalisa M. Hernandez[1] | Graham E. A. Bilbrough[2] | Dennis B. DeNicola[2] | Celine Myrick[2] | Suzanne Edwards[2] | Jeremy M. Hammond[2] | Alex N. Myers[1] | Johanna C. Heseltine[3] | Karen Russell[1] | Marco Giraldi[4] | Mary B. Nabity[1]

SediVue (Idexx)

- Designed to perform automated urine sediment analysis
- It has been shown to exhibit
  - good agreement with manual microscopy for the detection of
    - Red blood cells
    - White blood cells
    - Struvite crystals
    - Calcium oxalate crystals

Other similar instruments are available in the veterinary market BUT studies have not been published

- Improvement is needed for the detection of
  - Casts
  - Squamous epithelial cells
  - Non-squamous epithelial cells

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Journal of Veterinary Internal Medicine ACVIM Open Access
American College of Veterinary Internal Medicine
STANDARD ARTICLE

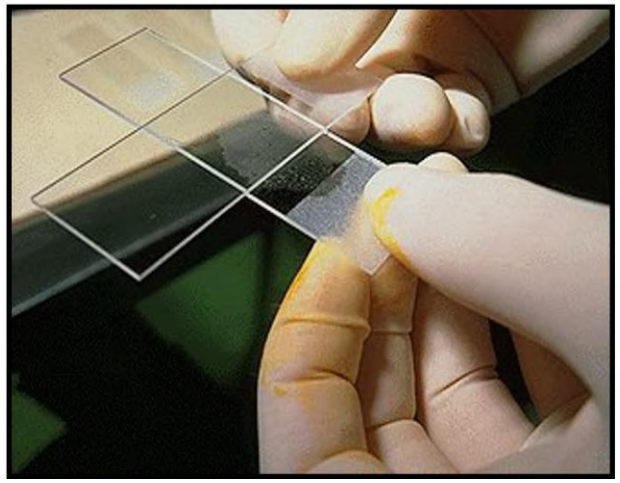
Comparison of IDEXX SediVue Dx® urine sediment analyzer to manual microscopy for detection of casts in canine urine

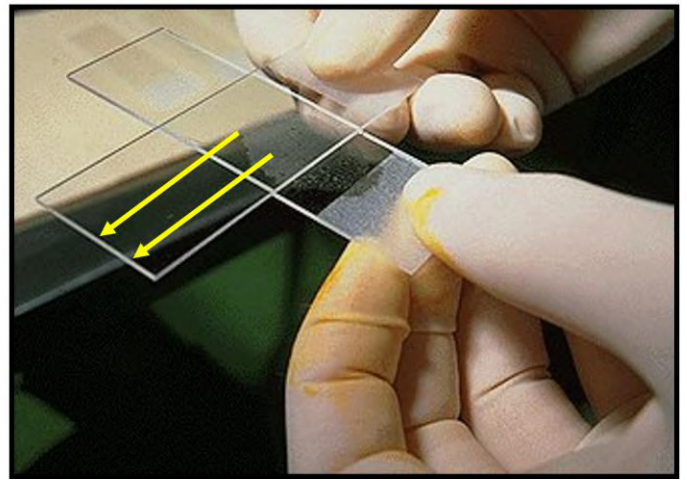
Demitria M. Vasilatis[1] | Larry D. Cowgill[2] | Giosi Farace[3] | Sarah Peterson[3] | Murthy Yerramilli[3] | Sean D. Owens[1]

Cytology of urine sample

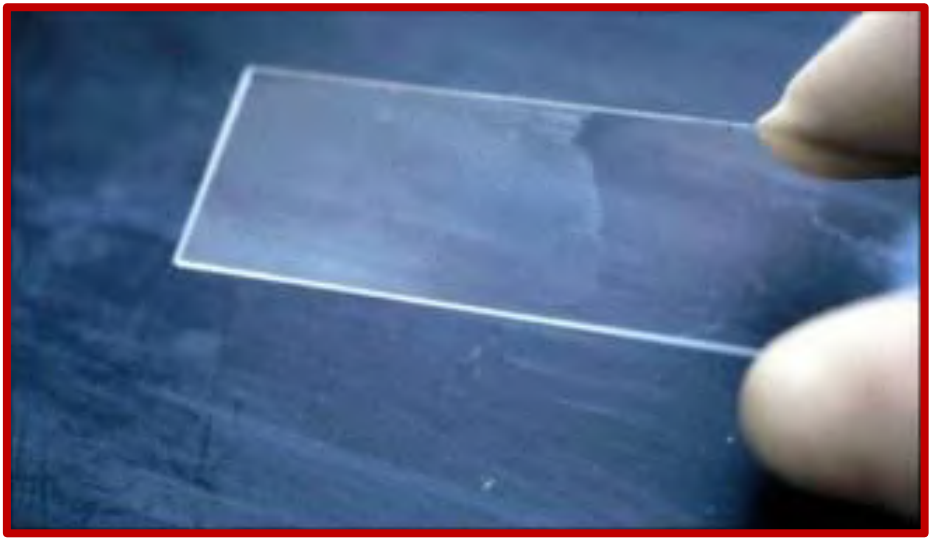
5

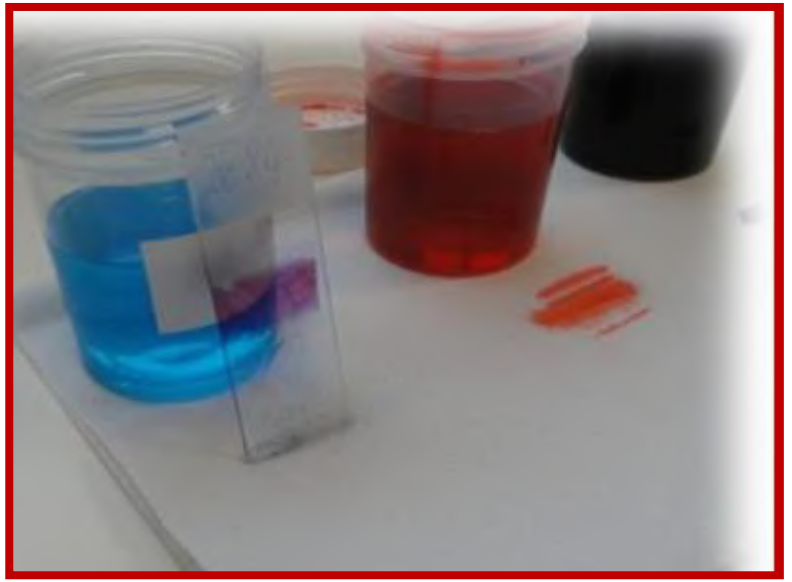
Use a pipette to transfer one drop of the reconstituted sediment to a microscope slide.





Smears should be left to air dry or can be dried quickly using
a hair blow-dryer (set at medium for 15-30 seconds);
can be stained using rapid Romanowsky stains (e.g., Diff-Quik®).





Tusen takk!

Har du noen spørsmål?