Lecture 7

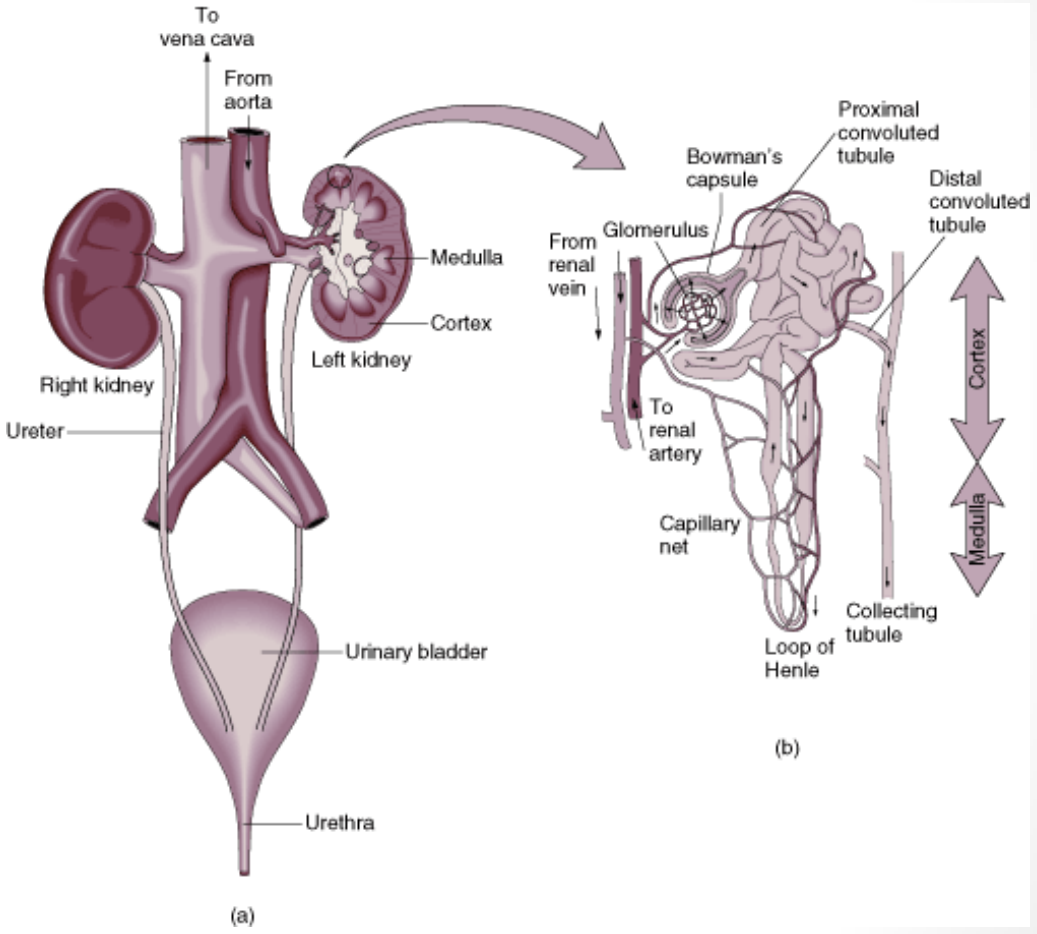
The Urinary System

The Urinary System

- The urinary system removes wastes from the body
- The urinary system also maintains homeostasis or a constant internal environment within the body
- Urin/o and ur/o are both combining forms for the urinary system

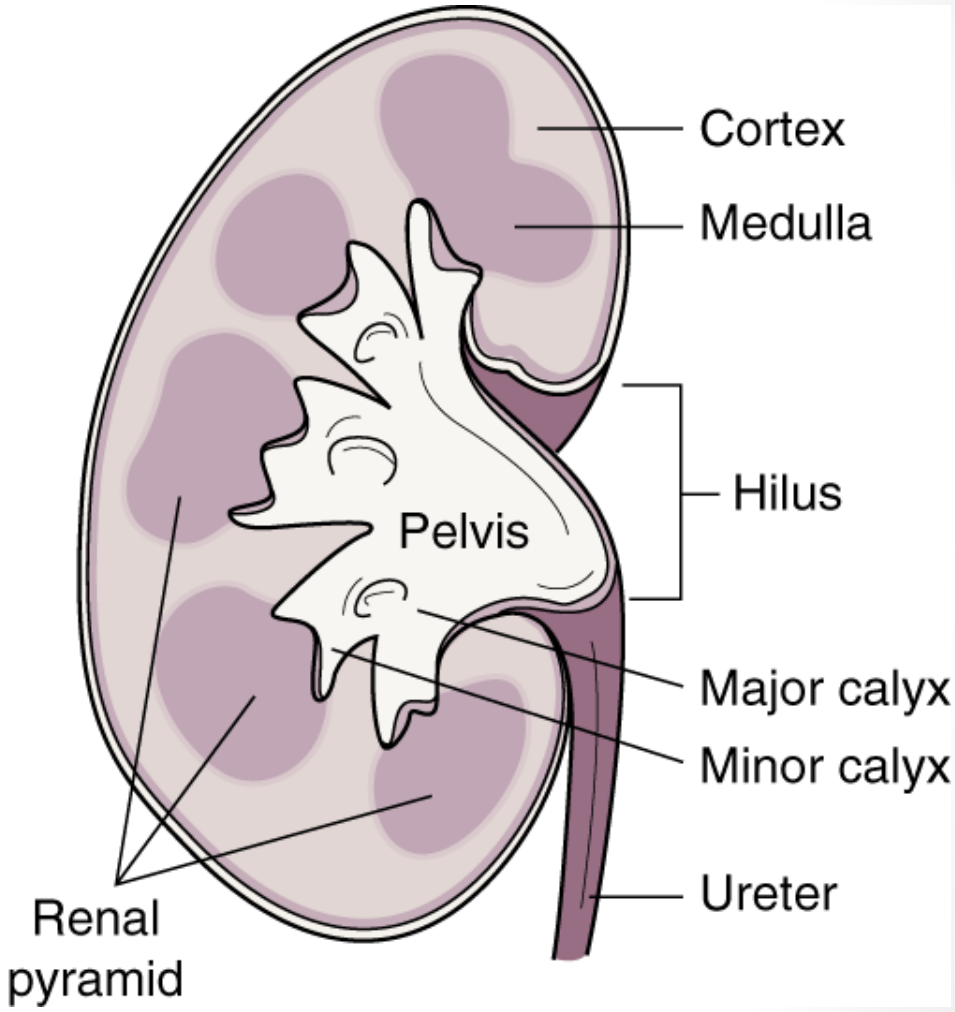
Parts of the Urinary System

- The structures of the urinary system include
  - a pair of kidneys
    - ren/o and nephr/o
  - a pair of ureters
    - ureter/o
  - a single urinary bladder
    - cyst/o
  - a single urethra
    - urethr/o



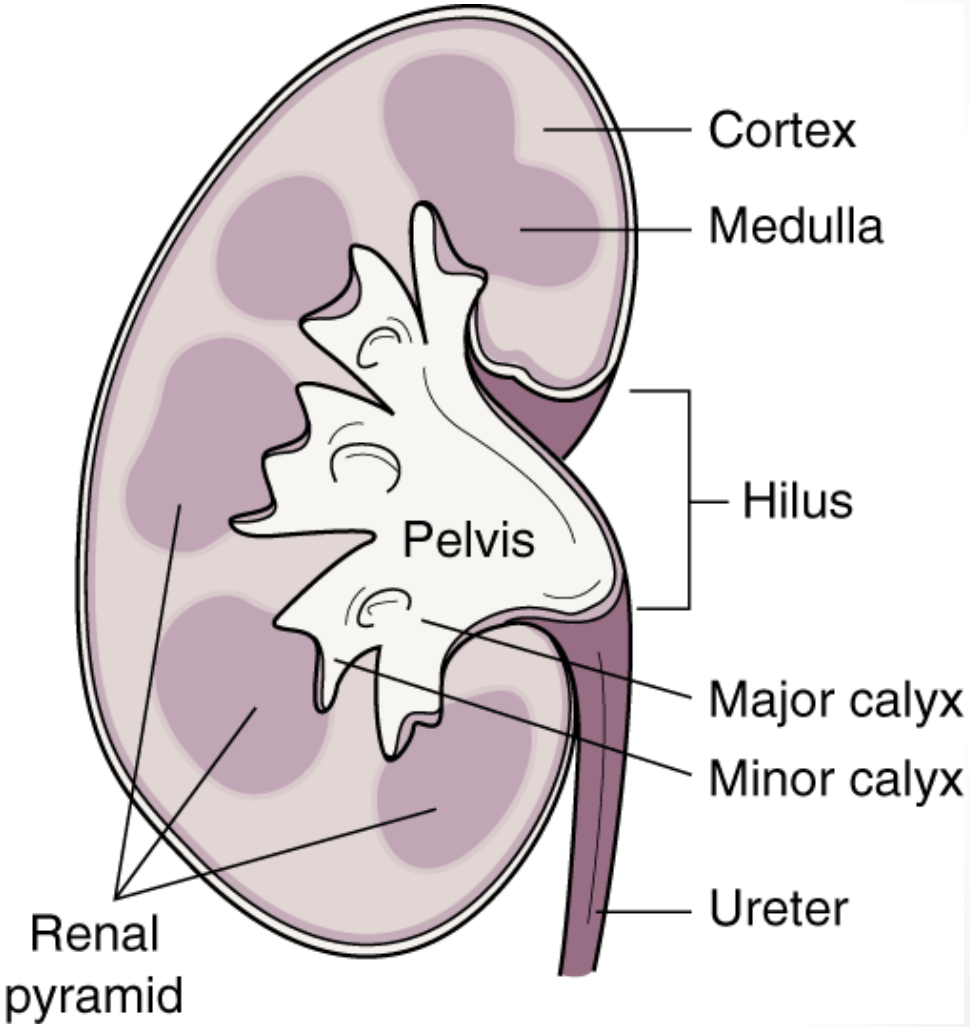
Kidney

- The kidneys are located behind the lining of the abdominal cavity or retroperitoneally
- The concave depression where blood vessels, nerves, and the ureter attach is called the hilus
- There are two parts of the kidney
  - The renal cortex is the outer part
    - cortic/o means outer region
  - The renal medulla is the inner part
    - medull/o means inner



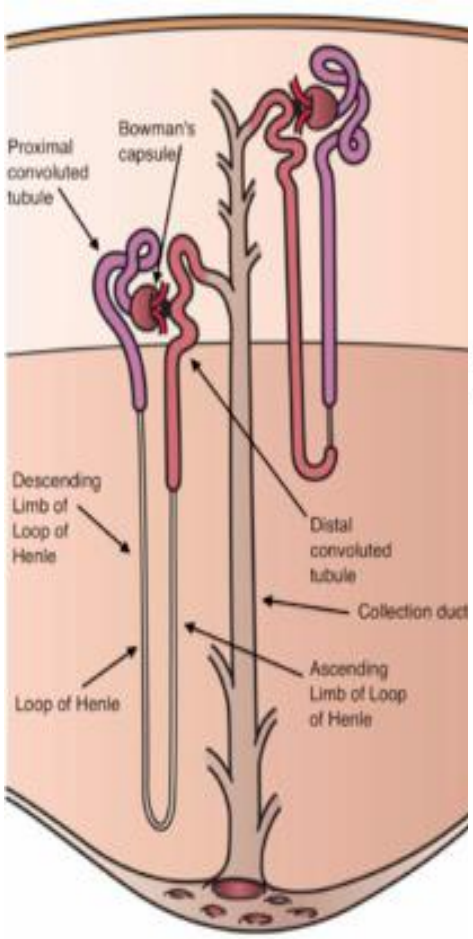
Kidney Structures

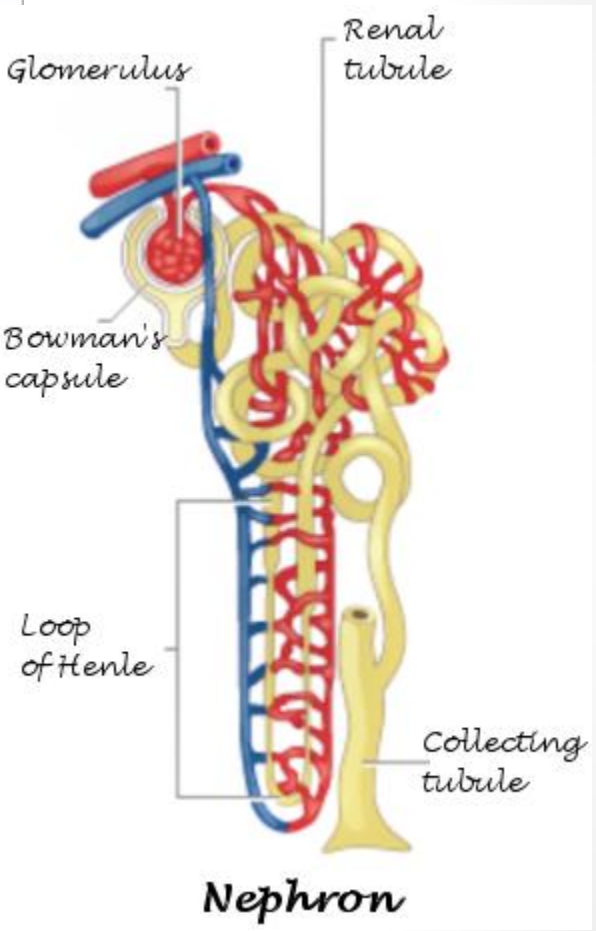
- Structures of the kidney include
  - Nephron (functional unit of the kidney)
  - Renal pelvis (area of the kidney where urine collects before entering the ureters) is present in some species
    - Pyel/o means renal pelvis



Nephron Structures

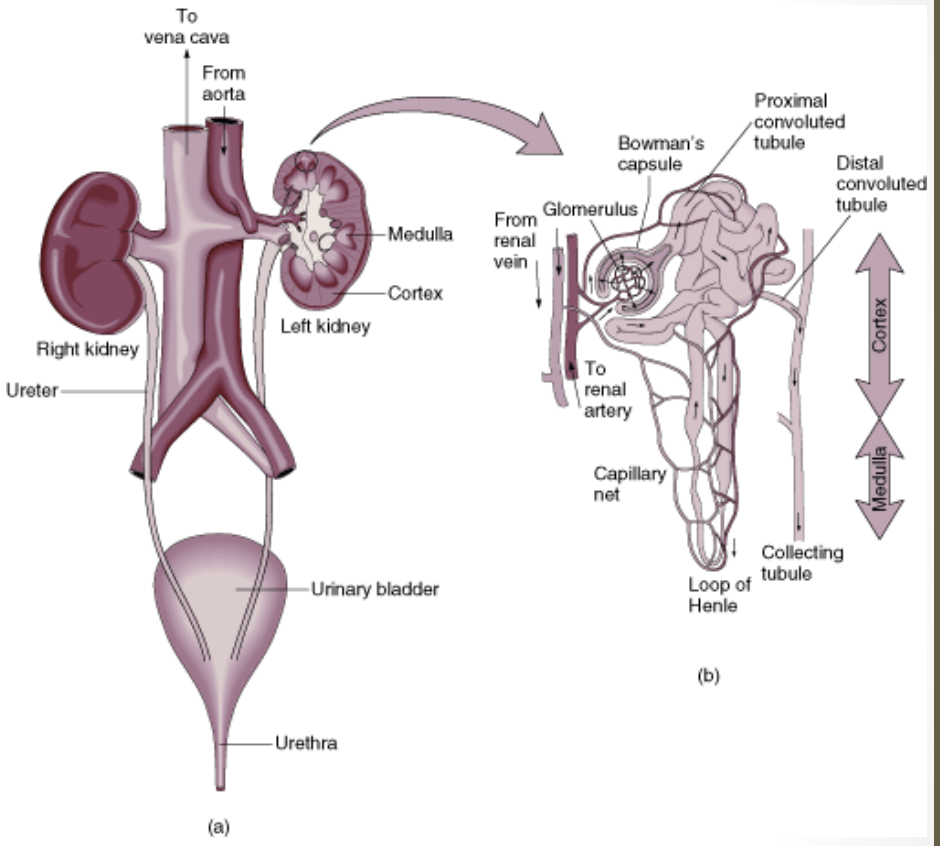
- Structures of the nephron include
  - Glomerulus = cluster of capillaries
    - glomerul/o
  - Bowman's capsule = cup-shaped structure that contains the glomerulus
  - Proximal convoluted tubules = hollow tubes involved in reabsorption
  - Loop of Henle = U-shaped turn that is involved in reabsorption
  - Distal convoluted tubules = hollow tubes involved in secretion
  - Collecting tubules = hollow tubes that carry urine from the cortex to the renal pelvis



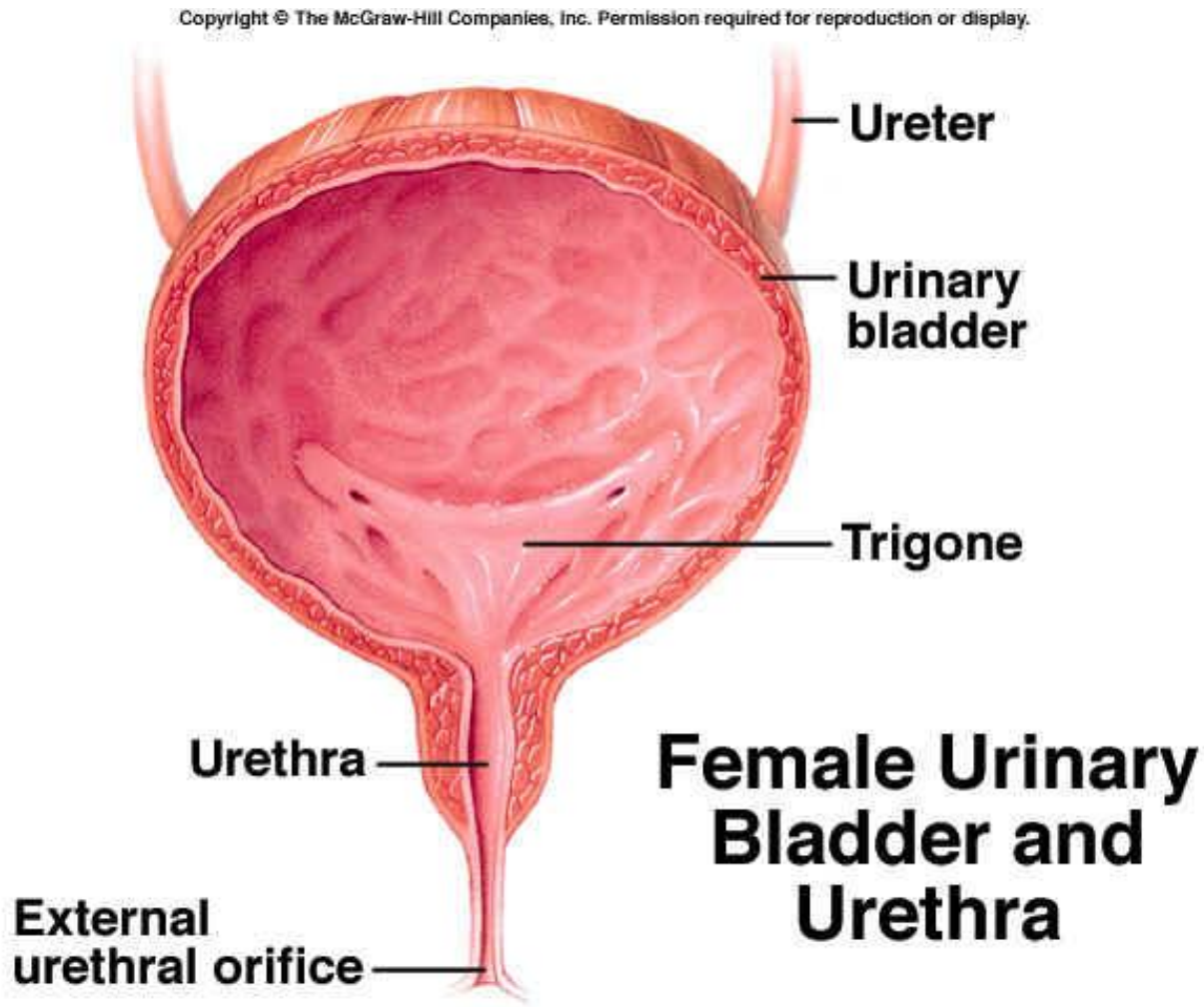


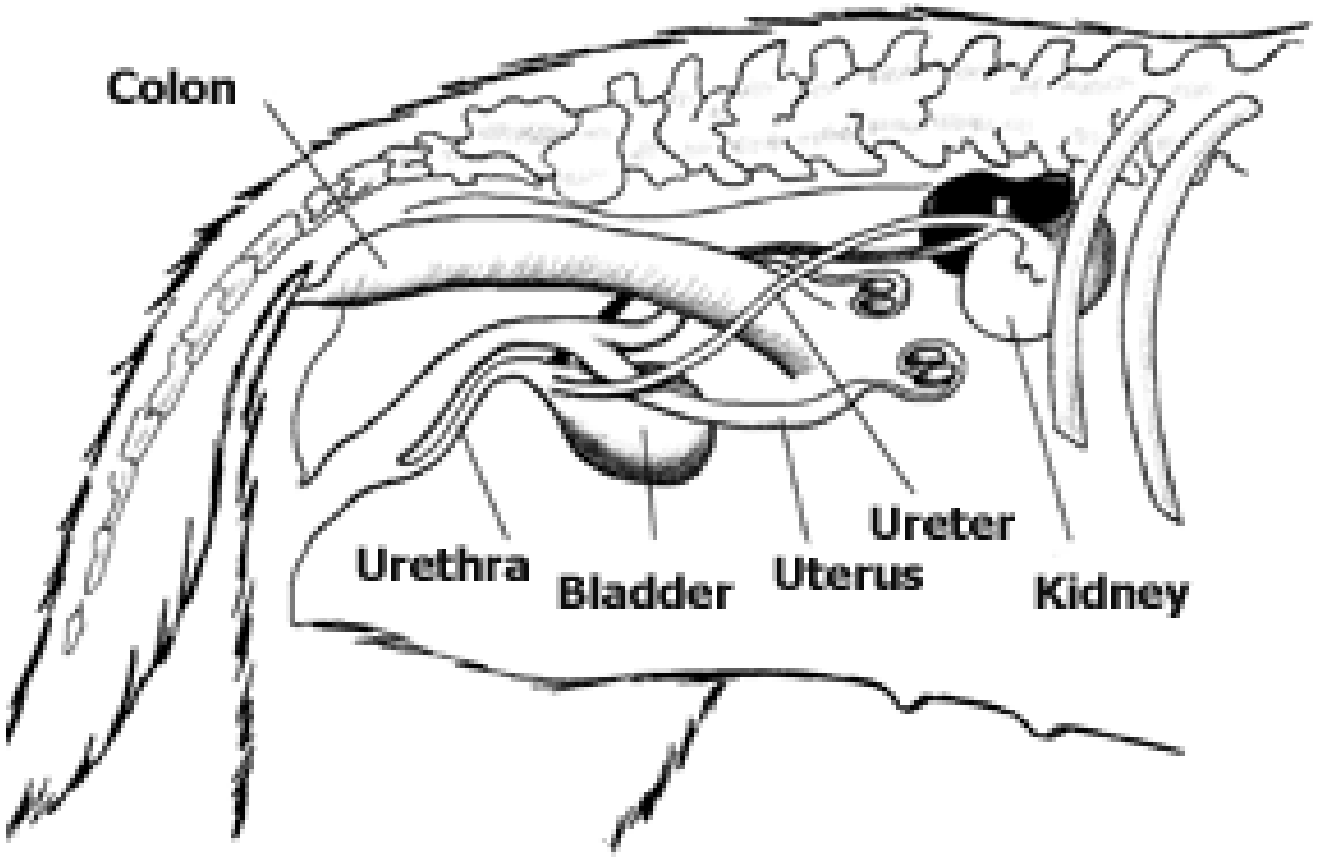
Ureters, Urinary Bladder, and Urethra

- Ureters are a pair of narrow tubes that carry urine from the kidneys to the urinary bladder
  - Ureter/o means ureter
- The urinary bladder is a singular hollow muscular organ that holds urine
  - Cyst/o means urinary bladder
- The urethra is a tube extending from the urinary bladder to the outside of the body
  - Urethr/o means urethra



Urinary Bladder



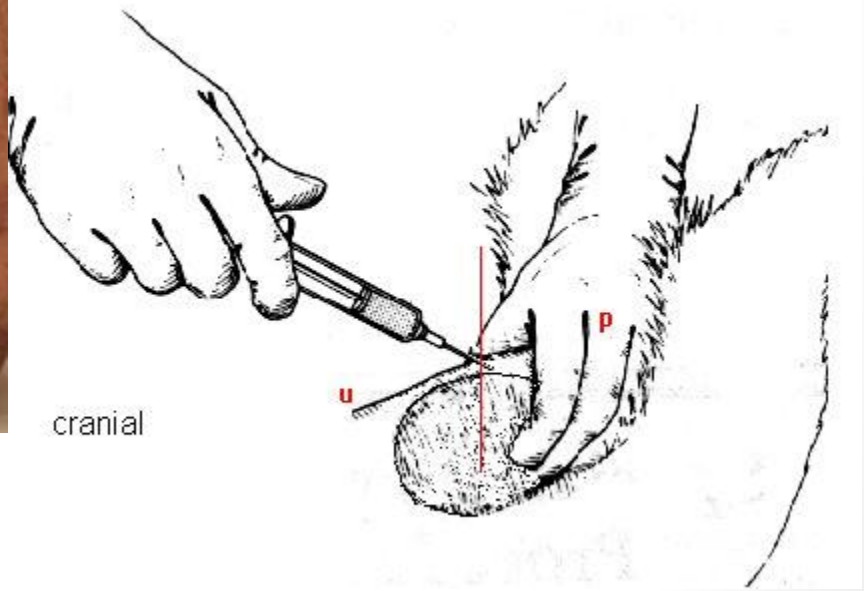

Colon
Urethra
Bladder
Uterus
Ureter
Kidney

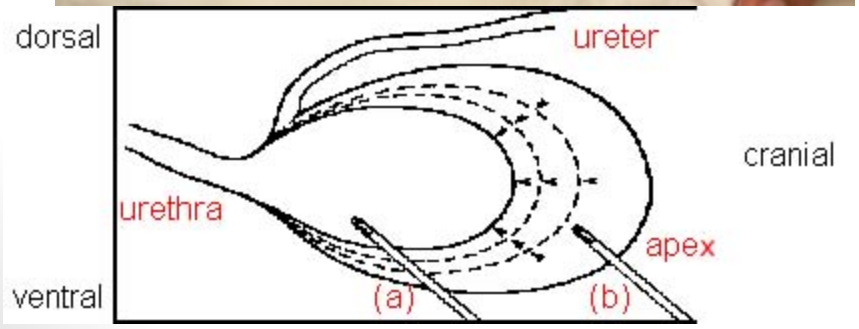
Urine Production

- The process of urine production is uropoiesis
  - -poiesis means formation
- Normal urine is clear and pale yellow in most species
  - -chrome means color
  - Turbid means cloudy
- Urin/o and ur/o are both combining forms for the urinary system

Cystocentesis

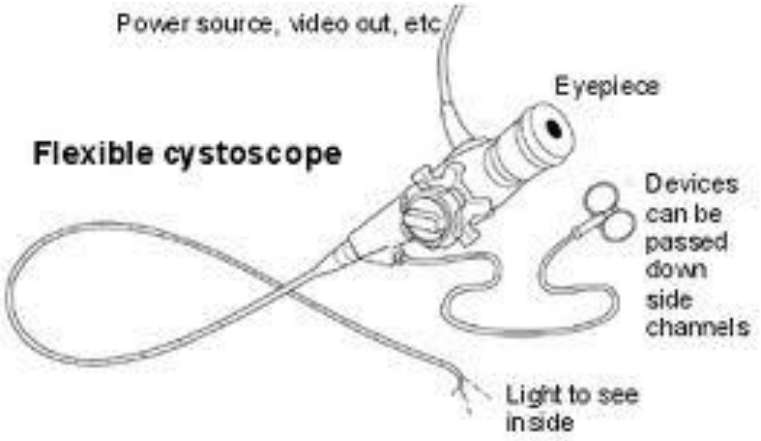
- Cystocentesis = surgical puncture of the urinary bladder to collect urine. Usually performed using a needle and syringe

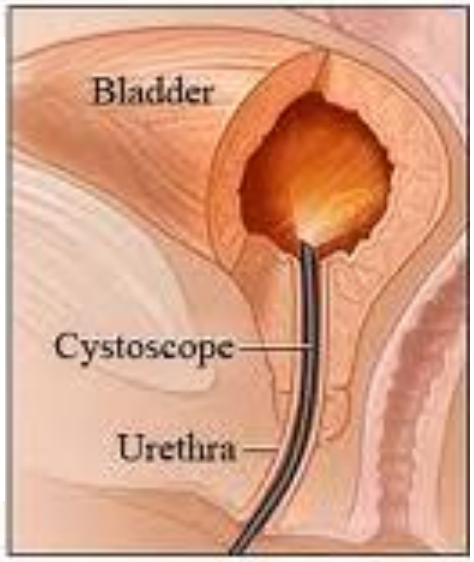




Cystoscopy

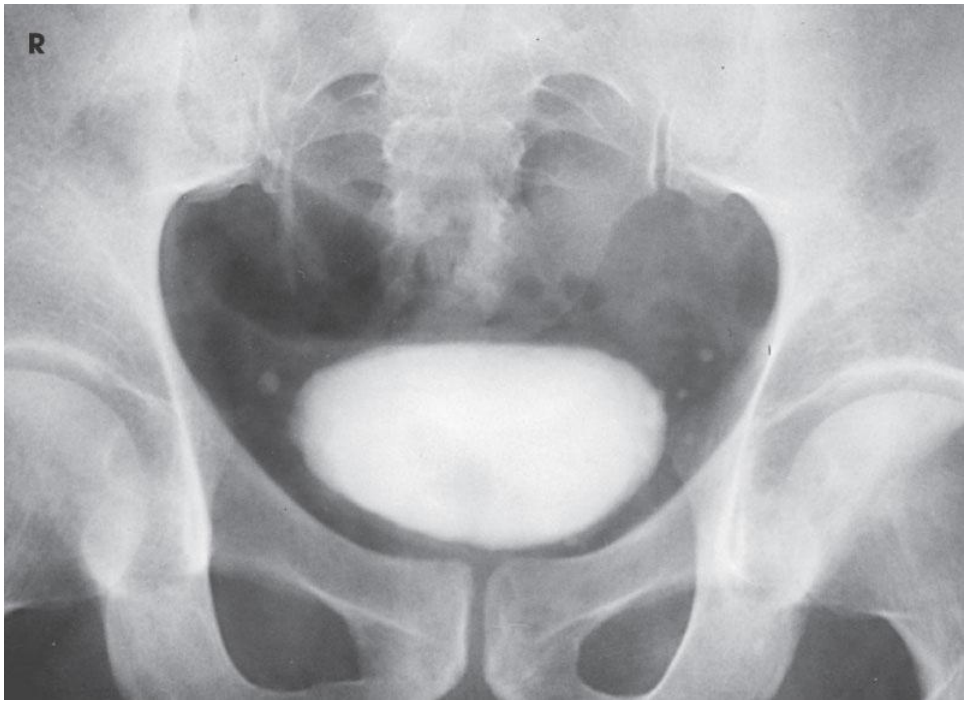
- Cystoscopy = visual examination of the urinary bladder using a cystoscope.
- Cystoscope = fibreoptic instrument used to access the interior of the urinary bladder.





Cystogram & Radiography

- Cystogram = is the radiographic film of the bladder after a contract material has be added to the bladder.
- Radiography = X-ray



Urinalysis (UA)

- Examination of urine components. Abbreviation = UA. This can be done for many components using a simple dipstick method.
- Urinalysis can be used to tell us about pH, leukocytes, erythrocytes, protein, glucose, bilirubin, etc.

urinary crystals

TYPE OF URINE	TYPE OF CRYSTALS	DESCRIPTION OF CRYSTALS	SIGNIFICANCE WHEN FOUND IN URINE
Normal Acid Urine	amorphous urate	colorless or yellow-brown granules (pink macroscopically)	nonpathologic
	uric acid	occur in many shapes; may be colorless, yellow-brown or red-brown; and square, diamond-shaped, wedge-shaped, or grouped in rosettes	usually nonpathologic; in large numbers, may indicate gout
	calcium oxalate	octahedral or dumbbell-shaped; possess double refractive index	usually nonpathologic; may be associated with stone formation
Normal Alkaline Urine	amorphous phosphates	small, colorless, granules	nonpathologic
	triple phosphates	colorless prisms with three to six sides ("coffin-lids") or feathery shaped like fern leaves	usually nonpathologic; may be associated with urine stasis or chronic urinary tract infection
	ammonium biurate	yellow-brown "thorny apple" appearance or yellow-brown spheres	nonpathologic
	calcium phosphate	colorless prisms or rosettes	usually nonpathologic; may be associated with urine stasis or chronic urinary tract infection
	calcium carbonate	usually appear colorless and amorphous; may be shaped like dumbbells, rhombi, or needles	usually nonpathologic; may be associated with inorganic calculi formation

PANEL 5.5A (cont.)

TYPE OF URINE	TYPE OF CRYSTALS	DESCRIPTION OF CRYSTALS	SIGNIFICANCE WHEN FOUND IN URINE
Abnormal Urine	tyrosine	thin, dark needles, arranged in sheaves or clumps; usually colorless, but may be pale yellow-brown	liver disease or inherited metabolic disorder
	leucine	yellow-brown spheres with radial striations	liver disease or inherited metabolic disorder
	cystine	clear, hexagonal plates	cystinuria
	hippuric acid	star-shaped clusters of needles, rhombic plates, or elongated prisms; may be colorless or yellow-brown	usually nonpathologic
	bilirubin	delicate needles or rhombic plates; red-brown in color; birefringent	bilirubinuria
	cholesterol	colorless, transparent plates with regular or irregular corner notches	chyluria, urinary tract infections, nephrotic syndrome
	creatine	pseudohexagonal plates with positive birefringence	destruction of muscle tissue due to muscular dystrophies, atrophies, and myositis
	aspirin	distinctive prismatic or star-like forms; usually colorless; show positive birefringence	ingestion of aspirin or other salicylates
	sulfonamide	yellow-brown dumbbells, asymmetrical sheaves, rosettes, or hexagonal plates	ingestion of sulfonamide drugs
	ampicillin	long, thin, clear crystals	parenteral administration of ampicillin
	x-ray media	long, thin rectangles or flat, four-sided, notched plates	x-ray procedure with contrast media

PANEL 5.5B

urinary crystals

Normal Acid Urine

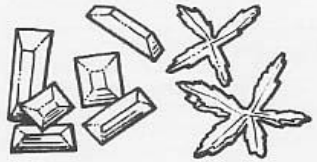
Amorphous Urate

Uric Acid

Calcium Oxalate

Normal Alkaline Urine

Amorphous Phosphate



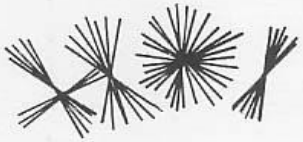
Triple Phosphate

Ammonium Biurate

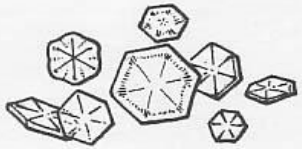
Calcium Phosphate

Calcium Carbonate

Abnormal Urine



Tyrosine



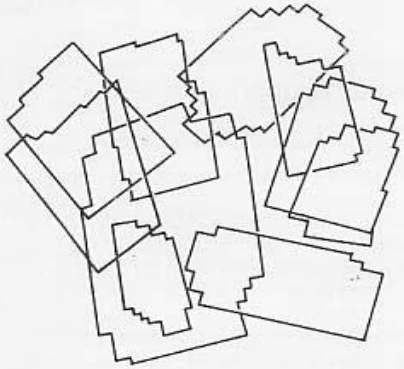
Cystine

Leucine

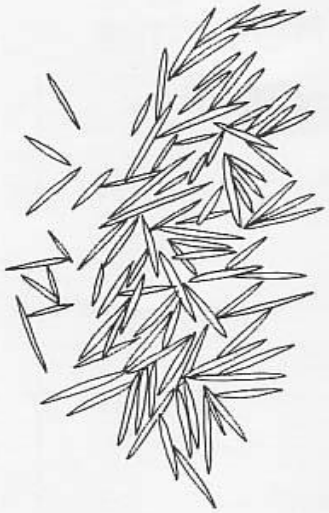
Sulfa

PANEL 5.5B (cont.)

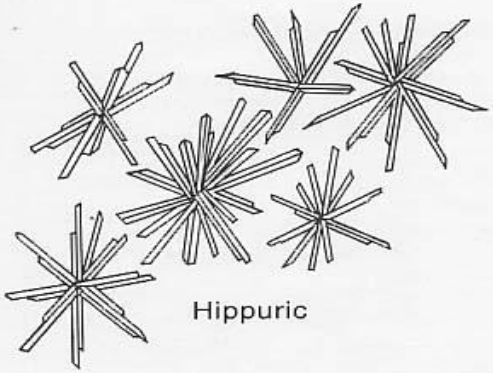
Abnormal Urine



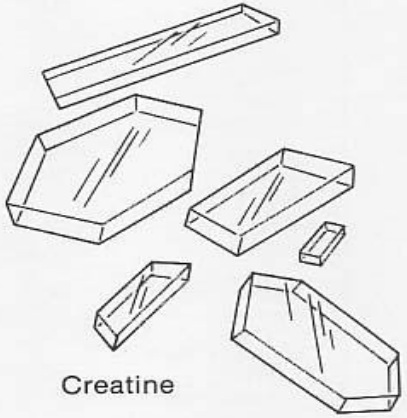
Cholesterol



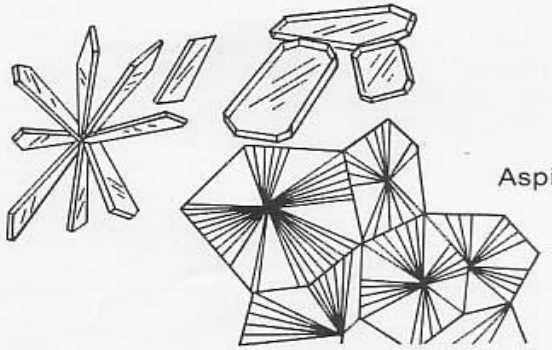
Bilirubin



Hippuric

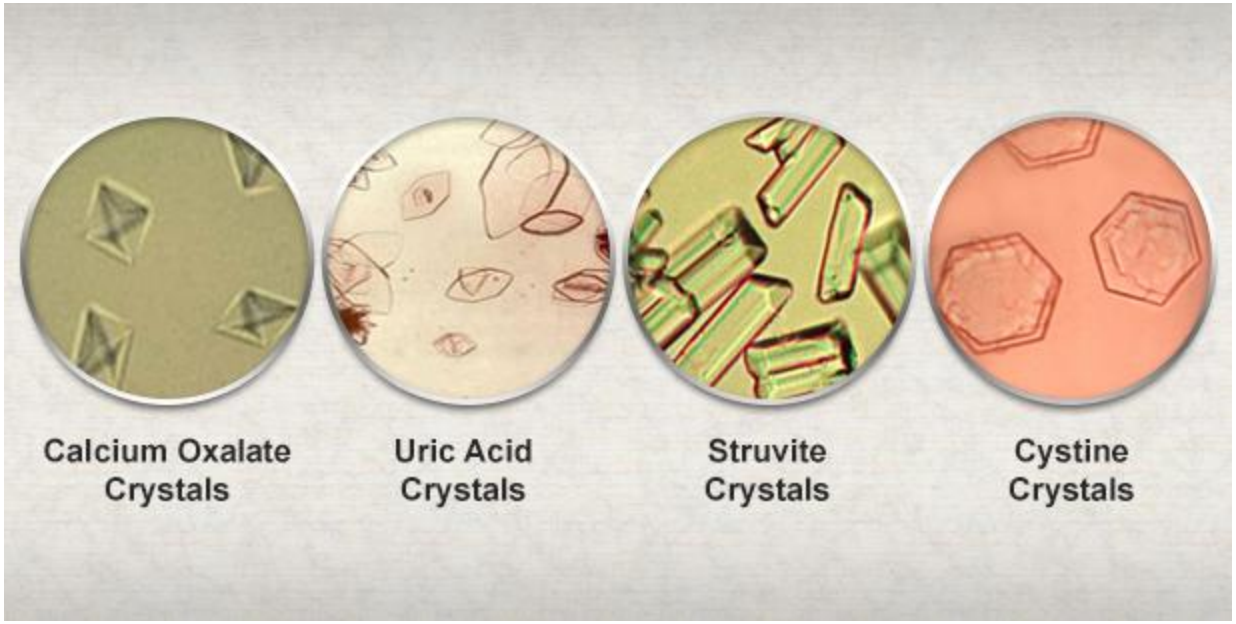


Creatine



Aspirin

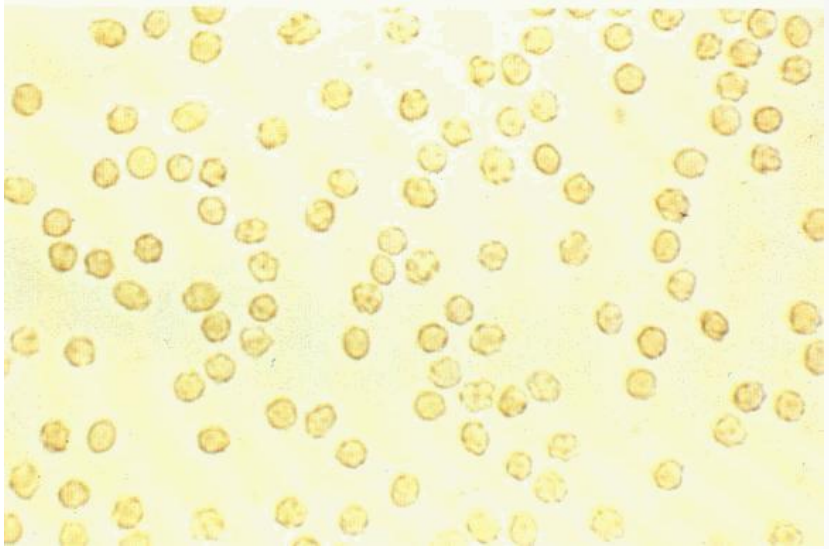
Acid Urine Crystals



Cystine crystalluria or urolithiasis is an indication of cystinuria, which is an inborn error of metabolism involving defective renal tubular reabsorption of certain amino acids including cystine. Sex-linked inheritance is suspected since male dogs are almost exclusively affected. Many breeds, as well as mongrels, have been reported affected . Renal function otherwise appears to be normal and, aside from a tendency to form uroliths, the defect is without serious consequence.

Cells found in Urine

- Blood cells – white and red
- Bacteria
- Fungi
- Parasite



Medical Terms for the Urinary System

- Anuria
  complete suppression of urine production
- Bacteriuria
  presence of bacteria in urine
- Crystalluria
  urine with naturally produced angular solid of definitive form (crystals)
- Dysuria
  difficult or painful urination
- Glucosuria
  glucose in urine
- Glycosuria
  glucose in urine
- Hematuria
  blood in urine

- Oliguria

Scant or little urine

- Pollakiuria

frequent urination

- Polyuria

excessive urination

- Proteinuria

presence of proteins in urine

- Pyuria

pus in urine

- Stranguria

Slow or painful urination

- Azotemia

presence of urea or other nitrogenous elements in the blood

- Cystalgia

urinary bladder pain (cystodynia

- Cystitis

inflammation of the urinary bladder

- Feline lower urinary tract disease

common disease of cats in which cystitis, urethritis, and crystalluria are found; formely called feline urologic syndrome (FUS)

- Glomerulonephritis

inflammation of the kidney involving the glomeruli

- Incontinence
- inability to control excretory functions
- Interstitial cystitis
- inflammation within the wall of the urinary bladder
- -lithiasis
- suffix meaning the presence of stones or calculi,
- Nephrectasis
- distention of the kidneys; distention means enlargement, and the suffix -ectasis means distention or stretching
- Nephritis
- inflammation of the kidneys
- Nephrolith
- kidney stone or renal calculus

- Pyelonephritis

inflammation of the renal pelvis and kidney

- Renal failure

inability of the kidneys to function; may be acute (occuring suddenly or over a short period) or chronic (having longer onset)

- Renal infarction

obstruction of blood flow to kidney

- Uremia

waste products in the blood. Uremia is seen with many types of kidney disease

- ureterolith

stone in the urethra

- urethritis

inflammation of the urethra

- Urinary retention

inability to completely empty the urinary bladder

- Urinary tract infection

invasion of microorganisms in the urniary system, which results in local cellular injury; UTI