Renal Topics

1) **renal function**
2) **renal system**
3) **urine formation**
4) **urine & urination**
5) **renal diseases**

Renal Functions

1) excrete metabolic wastes (blood cleaning)
2) maintain water salt balance (BV & BP)
3) maintain acid-base bal (blood pH)
4) secrete hormones-aldosterone, renin, & ANH
5) reabsorb nutrients
6) syn. vit D

#1: Excrete Wastes (clean blood cleaning)

remove body wastes (urea, creatinine, ammonia, uric acid)

urea source: protein (eg meat, soy) breakdown
→ ammonia waste (toxic to cells)
→ liver (CO_2 + ammonia→ urea (less toxic)
uremia: ↑urea in blood → arrthmia, vomit, resp. prob.

creatinine source: muscle metab. waste

uric acid: metabolic waste
gout (uric crystals in joints, esp. big toe):
- ↑ uric acid in blood → crystals precipitate

#2: Maint. Water-Salt Bal.

maint. correct levels of water
& salt/ions (Na^+, K^+, HCO_3^-, CA^{2+})

osmosis: ↑ salt level → water retention
→ ↑ blood volume* & ↑ blood pressure*

maint. correct salt levels
→ correct blood volume & blood pressure

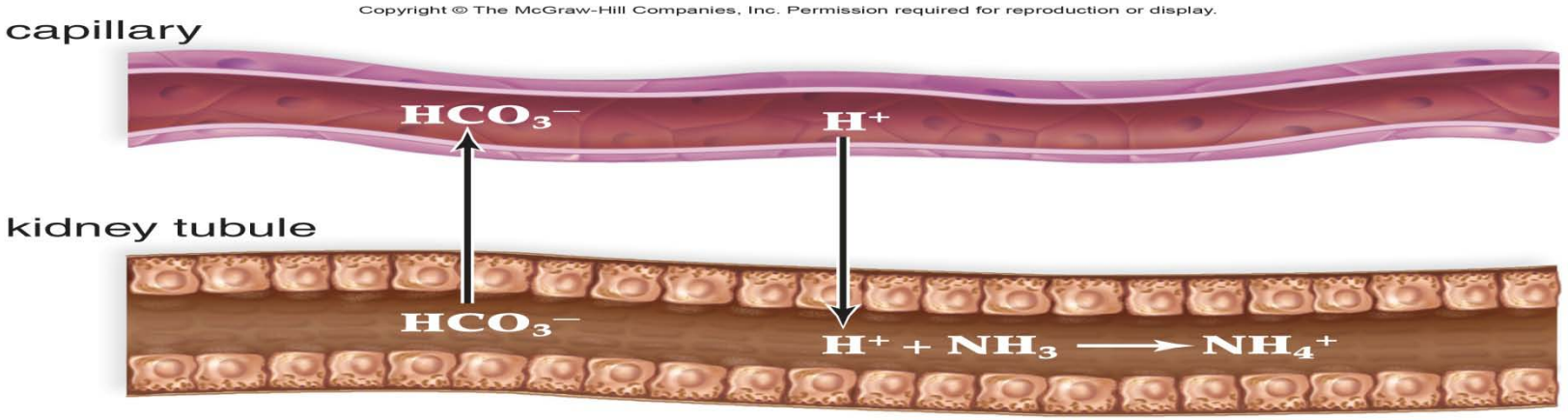
*** low salt diet for people with heart problems**

#3 Maint. Acid Base Bal.

maint. normal blood pH: 7.4

alkalosis: blood pH > 7.45 (diarrhea, ↓ CO_2)
acidosis: blood pH< 7.35 (orange juice or exercise)

blood buffers:
H_2CO_3 (carbonic acid) & HCO_3^- (bicarbonate ion)



#4 Secrete Hormones

secrete hormones: aldosterone, ADH, ANH

aldosterone (less urine)
- **produced by adrenal glands**
- **↑ ion reabsorption at DCT**

ADH (less urine)
- **produced by hypothalamus**
- **released by pituitary**
- **↑water reabsorption at DCT & coll. duct**

ANH (more urine)
- **produced by heart**
- **released with ↑ blood volume**

#6: Syn. Vitamin D

3 ways to synthesize Vitamin D:

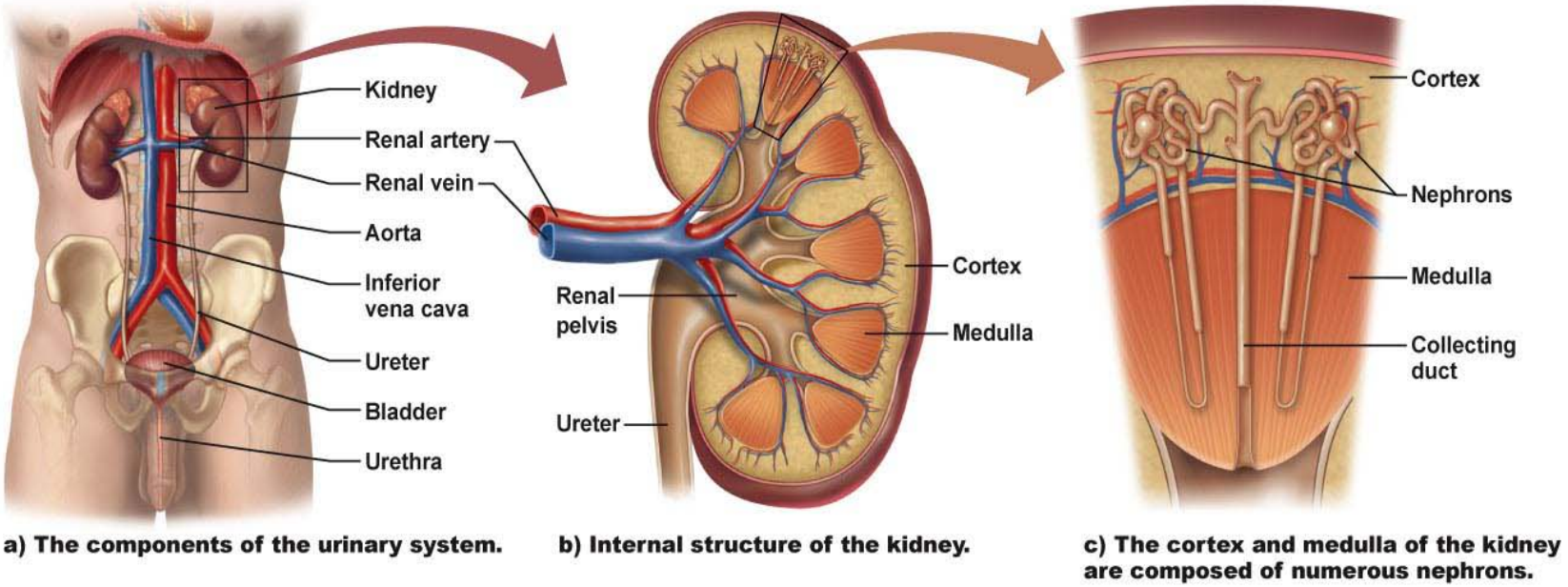
1) **skin - UV rays (sun)**
2) **liver - inactive**
3) **kidney - active**

assignment:

1) **short description of Vit. D synthesis**
2) **Why do lab tests show insufficient Vit. D levels in most people?**

Renal System

urinary system	kidney	nephron

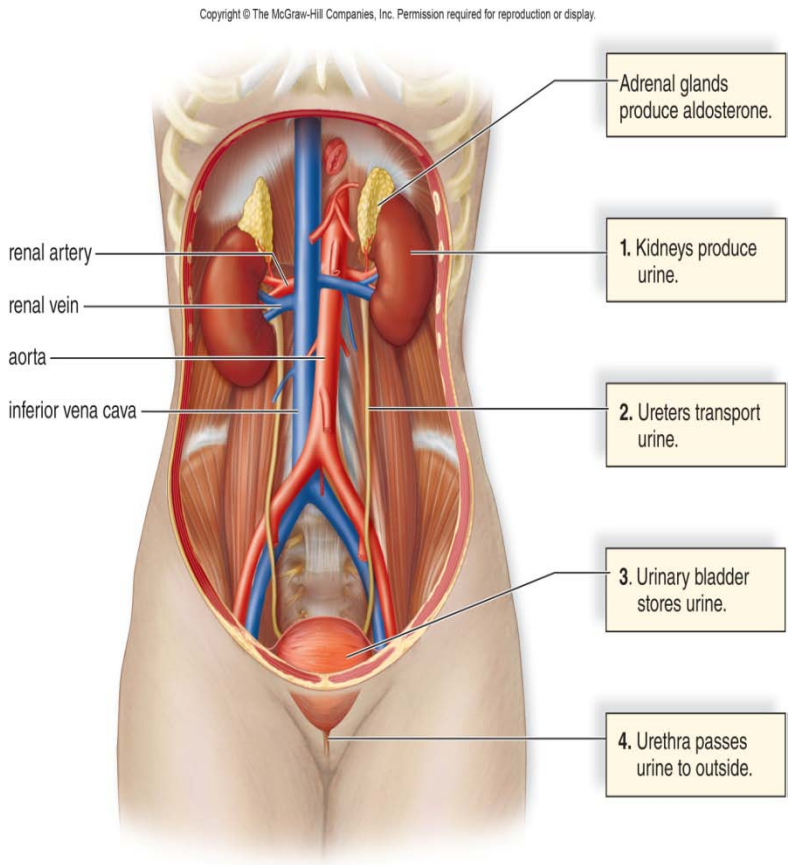


a) The components of the urinary system.

b) Internal structure of the kidney.

c) The cortex and medulla of the kidney are composed of numerous nephrons.

Urinary System Flows



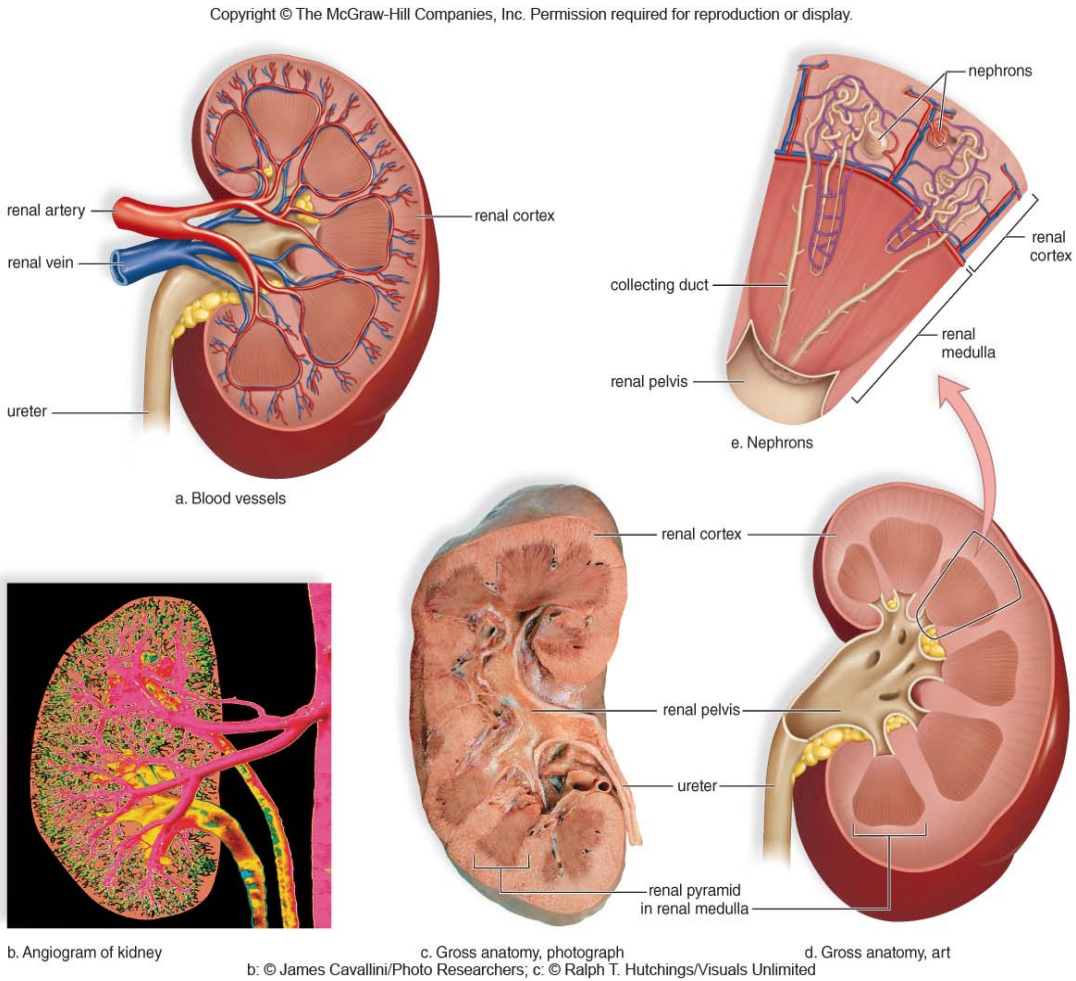
Urine Flow .

1) kidney
2) ureter
3) urinary bladder
4) urethra

Blood Flow .

1) aorta
2) renal artery
3) renal vein
4) inferior vena cava

Kidney Flows



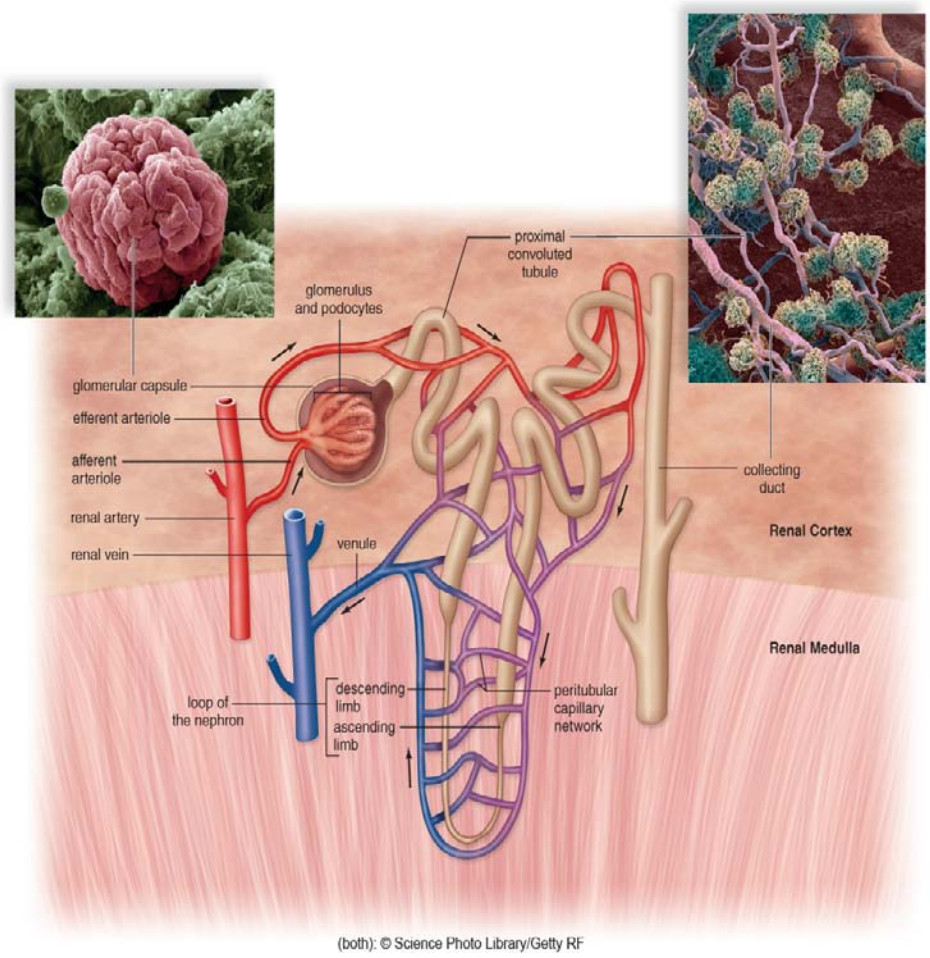
Urine Flow

1) cortex
2) medulla
3) renal pelvis
4) ureter

Blood Flow

1) renal artery
2) renal vein

Nephron Urine Flow



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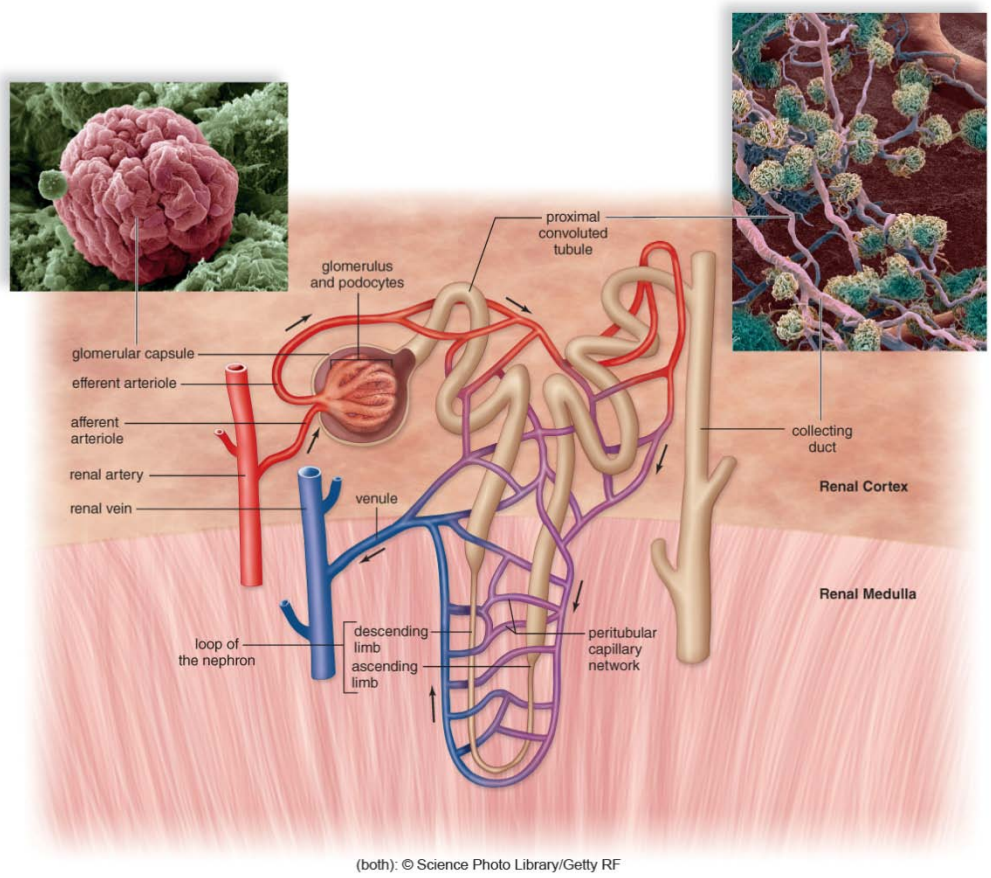
1) glomerular* cap.
2) prox. conv. tubule
3) descending limb
4) ascending limb
5) distal conv. tubule
6) collecting duct

*Bowman's capsule

Nephron Blood Flow



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1) artery*
2) afferent arteriole
3) glomerulus
4) efferent arteriole
5) peritub. cap.
6) vein*

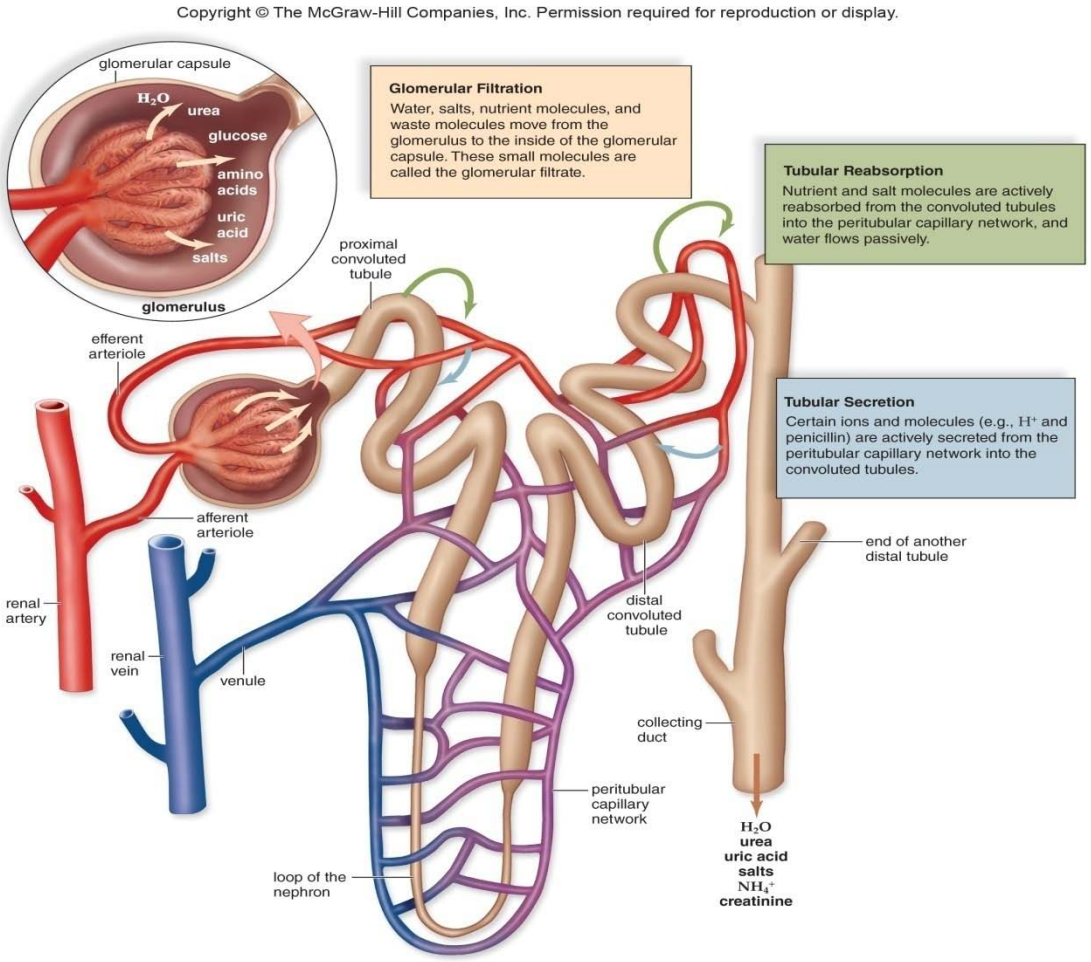
*not renal

Urine Formation

site = nephron

4 processes:

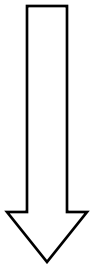
1) **filtration (F)**
2) **reabsorption (R)**
3) **secretion (S)**
4) **excretion (E)**



Filtration

filter blood (remove dirty plasma)
force: BP (blood pressure)

glomerulus: blood (becomes thicker)



plasma* removed

glomerular cap.: filtrate**

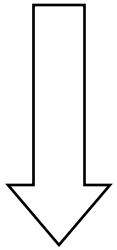
***water, nitrogenous waste, nutrients, salts**

****Bowman's capsule**

Secretion

remove wastes from blood
force: active transport, diffusion

peritub. cap.: blood (becomes cleaner)



remove wastes*

PCT: filtrate

***normal & foreign**

Waste Removal

secretion: remove wastes from blood

wastes:

1) normal - natural, prod. by body

- acid (H+), ammonium (NH4-), potassium (K+)

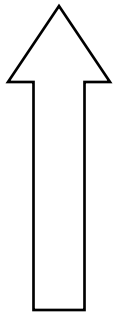
2) foreign - drugs, chem. not prod. by body

- penicillin, cocaine, morphine, marijuana, food preservatives, pesticides, saccharin

Reabsorption

return clean plasma to blood
force: A/T, diffusion

peritub. cap.: blood (normal viscosity)



blood regains plasma*

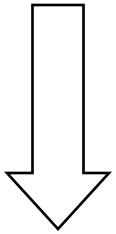
nephron: filtrate

***water, nitrogenous waste, nutrients, salts**

Excretion

force: vacuum & muscle (empty bladder)

collecting duct: filtrate



urine*

renal pelvis: urine

***wastes & excess water, salts, acid**

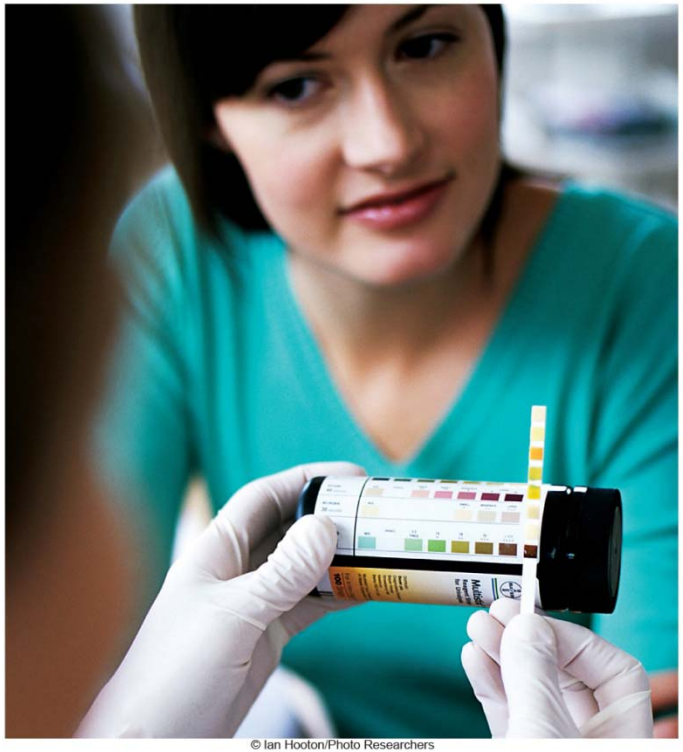
Urine

excretion: urine removed from body
force: urination (muscle contraction)

urine = water, wastes (natural & foreign),
excess plasma (ions, acids, water)

urine types:
1) concentrated: ↓ vol , ↑ salt (save water)
2) dilute: ↑ vol , ↓ salt (remove water)

Urinalysis



4 types:

1) **physical exam**
   - **color, clarity, odor**

2) **chemical exam**
   - **specific gravity, pH, glucose, bilirubin, ketones, proteins, nitrates, WBC**

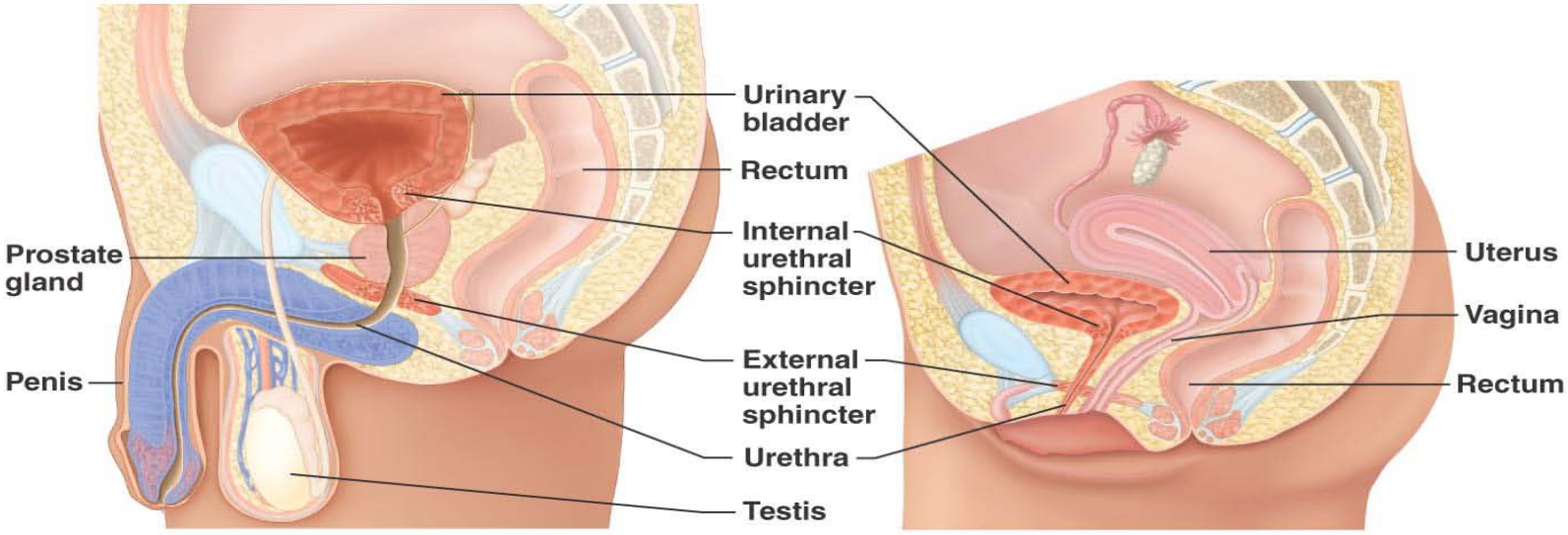
3) **microscopic exam**
   - **sediments (stones, protein)**

4) **forensic exam**
   - **illegal drugs, steroids**

Urination

Trace the flow of urination:

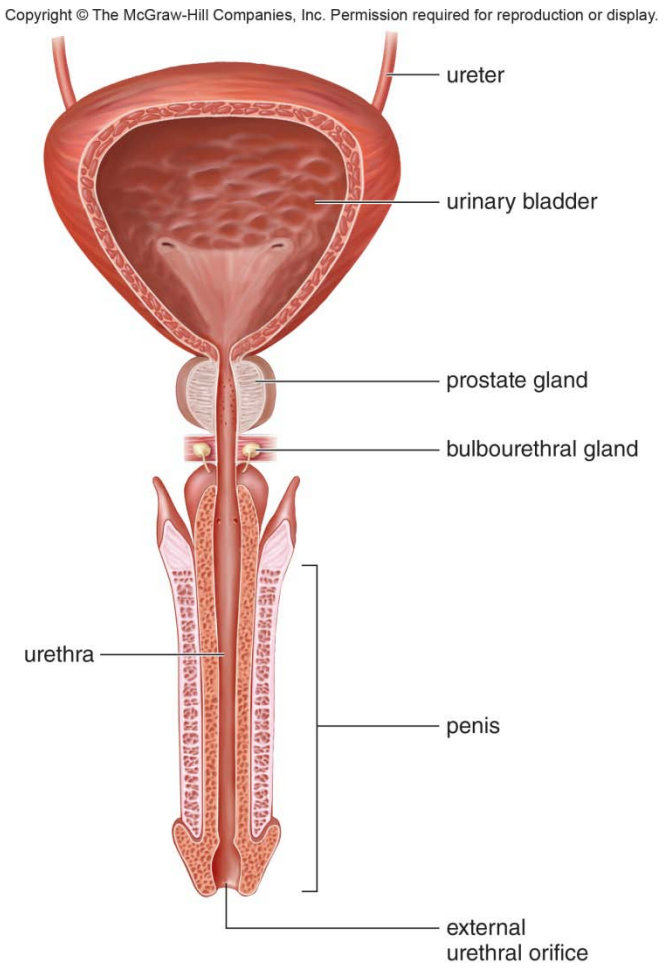
1) urinary bladder
2) internal ureth. sphincter
3) urethra (1st part)
4) internal ureth. sphincter
5) urethra (2nd part)
6) urethral opening



Diabetes Mellitis

diabetes mellitis
- insulin resistance or low levels
-> high blood glucose level
-> glucose in urine
-> less water is reabsorbed
-> frequent urination
-> increased thirst

Enlarged Prostate



prostate: produce semen

enlarged prostate:
- "walnut" -> lemon size
- squeezes urethra exiting urinary bladder
-> urination problem, bike riding problem

treatment:
- surgery to cut prostate
- drugs to shrink prostate

Renal Diseases

Describe the cause and effects:

1) **urethritis/cystitis/pyelonephritis**
2) **kidney stones**
3) **uremia**
4) **renal failure**
5) **enlarged prostate**