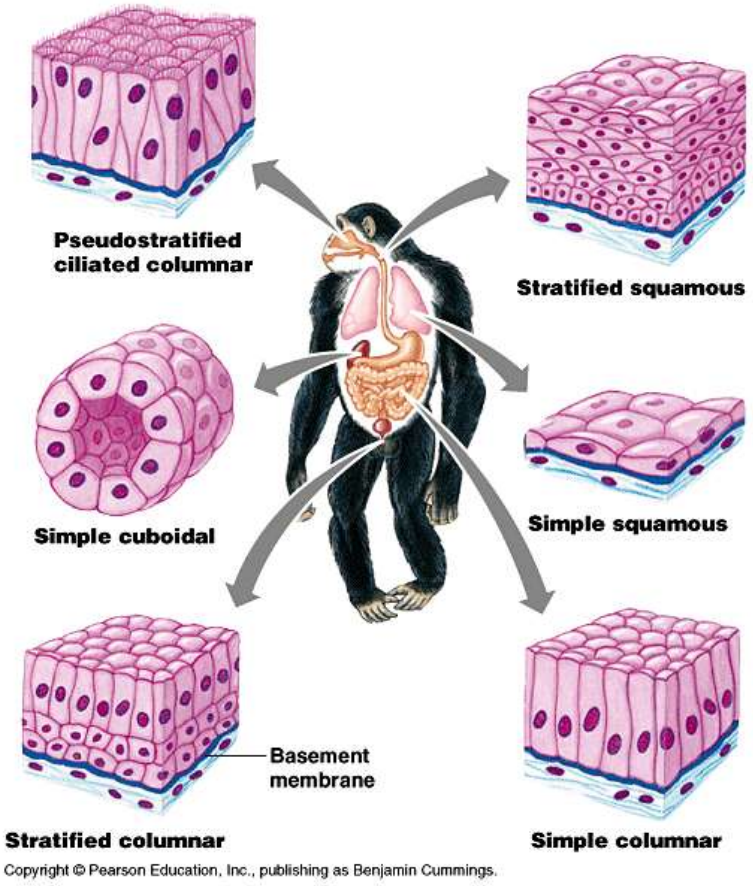
- Chapter 43
- *An Introduction to Animal Structure and Function*

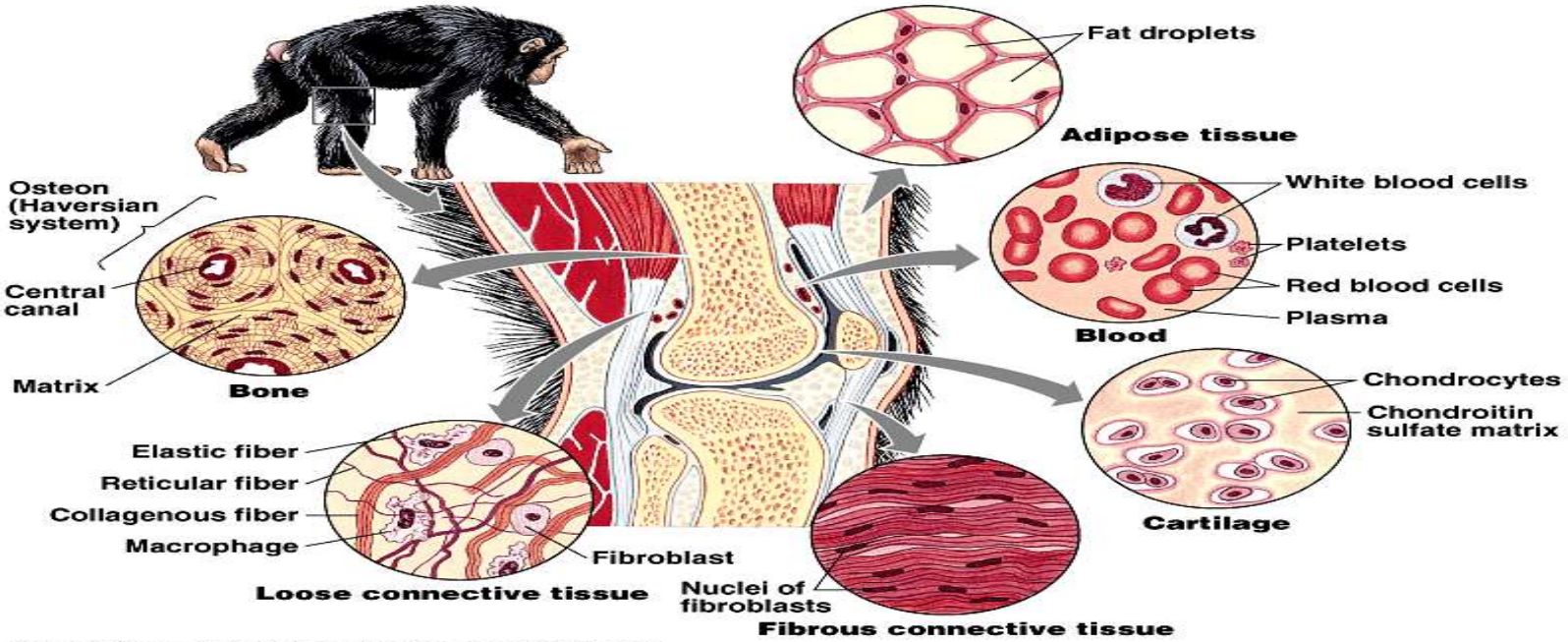
Tissues: groups of cells with a common structure and function (4 types)

- *Anatomy*: structure
- *Physiology*: function
- <u>1- Epithelial:</u> outside of body and lines organs and cavities; held together by tight junctions
- *basement membrane*: dense mat of extracellular matrix
- Simple: single layer of cells
- Stratified: multiple tiers of cells
- Cuboidal (like dice)
- Columnar (like bricks on end)
- Squamous (like floor tiles)
- mucous membrane



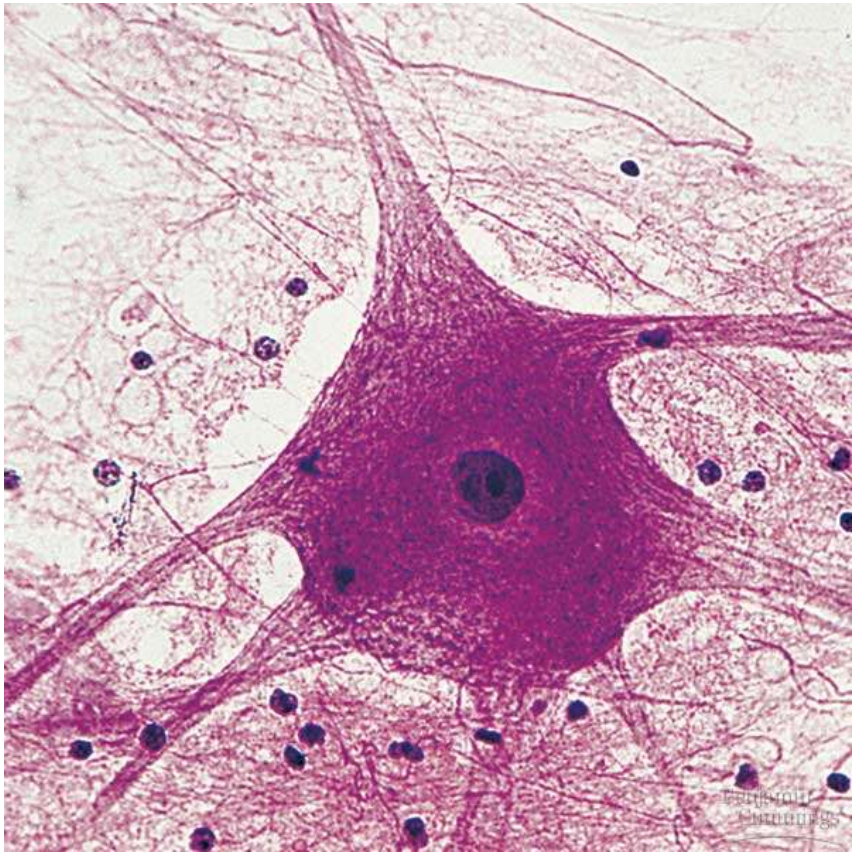
Tissues, II

- <u>2- Connective:</u> bind and support other tissues; scattered cells through matrix; 3 kinds:
- A-Collagenous fibers (collagen protein) B-Elastic fibers (elastin protein) C-Reticular fibers (thin branched collagen fibers)
- <u>Loose connective tissue:</u> binds epithelia to underlying tissue; holds organs
- 1-Fibroblasts- secretes extracellular proteins 2-Macrophages- amoeboid WBC's; phagocytosis 3-Adipose tissue- fat storage; insulation
- <u>Fibrous connective tissue:</u> parallel bundles of cells
- 1-Tendons- muscles to bones 2-Ligaments- bones to bones; joints (*BOBOL*I)
- <u>Cartilage</u>: collagen in a rubbery matrix (*chondroitin*); flexible support
- <u>Bone</u>: mineralized tissue by *osteoblasts*
- Blood: liquid plasma matrix; *erythrocytes* (RBC's) carry O2; *leukocytes* (WBC's) immunity



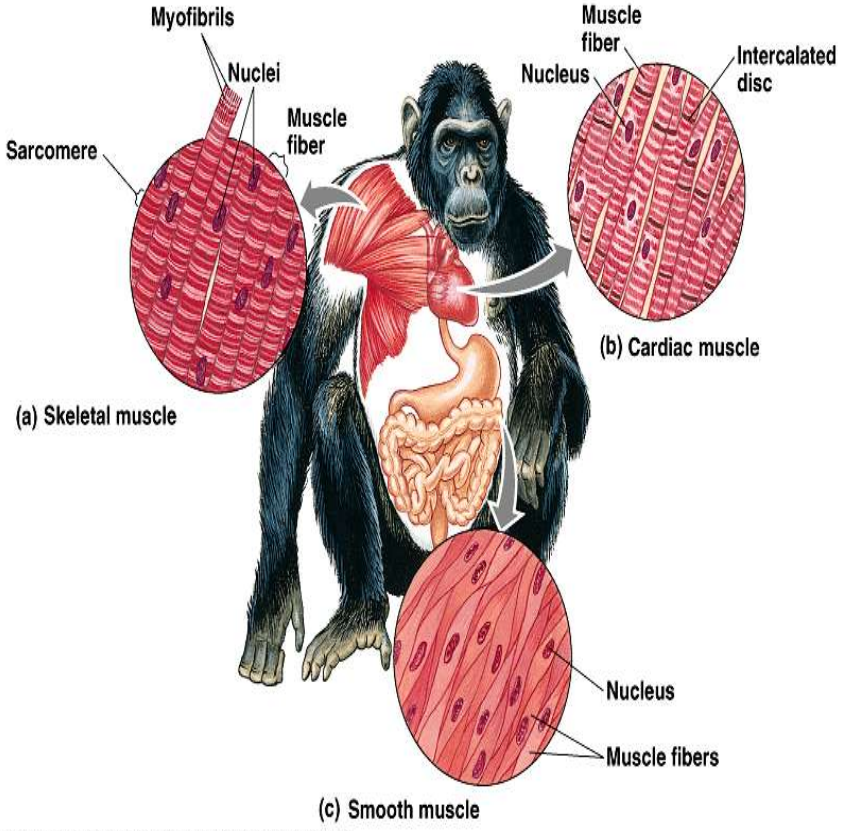
Tissues, III

- 3-Nervous: senses stimuli and transmits signals from 1 part of the animal to another
- *Neuron*: functional unit that transmits impulses
- *Dendrites*: transmit impulses from tips to rest of neuron
- *Axons*: transmit impulses toward another neuron or effector



Tissues, IV

- 4- Muscle: capable of contracting when stimulated by nerve impulses; myofibrils composed of proteins actin and myosin; 3 types:
- A- *Skeletal*: voluntary movement (striated)
- B- *Cardiac*: contractile wall of heart (branched striated)
- C- *Smooth*: involuntary activities (no striations)



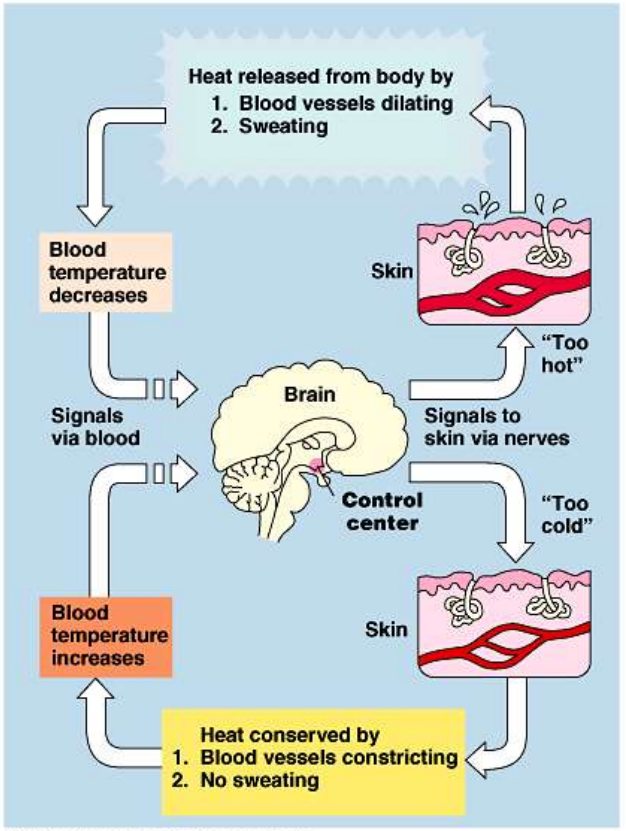
Organ systems

- Organ: organization of tissues
- Mesentaries: suspension of organs (connective tissue)
- Thoracic cavity (lungs and heart)
- Abdominal cavity (intestines)
- Diaphragm (respiration)
- Organ systems……

- *Digestive*-food processing
- *Circulatory*-internal distribution
- *Respiratory*-gas exchange
- *Immune/Lymphatic*-defense
- *Excretory*-waste disposal; osmoregulation
- *Endocrine*-coordination of body activities
- *Reproductive*-reproduction
- *Nervous*-detection of stimuli
- *Integumentary*-protection
- *Skeletal*-support; protection
- *Muscular*-movement; locomotion

Internal regulation

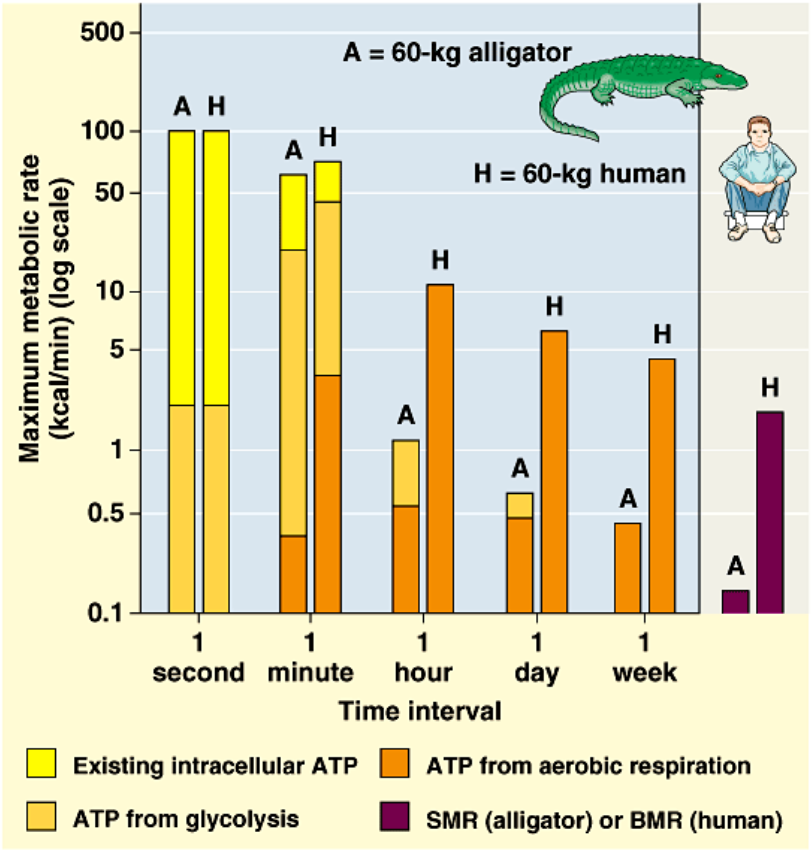
- *Homeostasis*: "steady state" or internal balance
- *Negative feedback*: change in a physiological variable that is being monitored triggers a response that counteracts the initial fluctuation; i.e., body temperature
- *Positive feedback*: physiological control mechanism in which a change in some variable triggers mechanisms that amplify the change; i.e., uterine contractions at childbirth



(b) Control of body temperature

Metabolism: sum of all energy-requiring biochemical reactions

- Catabolic processes of cellular respiration
- Calorie; kilocalorie/C
- *Endotherms*: bodies warmed by metabolic heat
- *Ectotherms*: bodies warmed by environment
- *Basal Metabolic Rate* (BMR): minimal rate powering basic functions of life (endotherms)
- *Standard Metabolic Rate* (SMR): minimal rate powering basic functions of life (ectotherms)



QOD?

- What are the costs and benefits of maintaining homeostasis?

Vocabulary for concept map

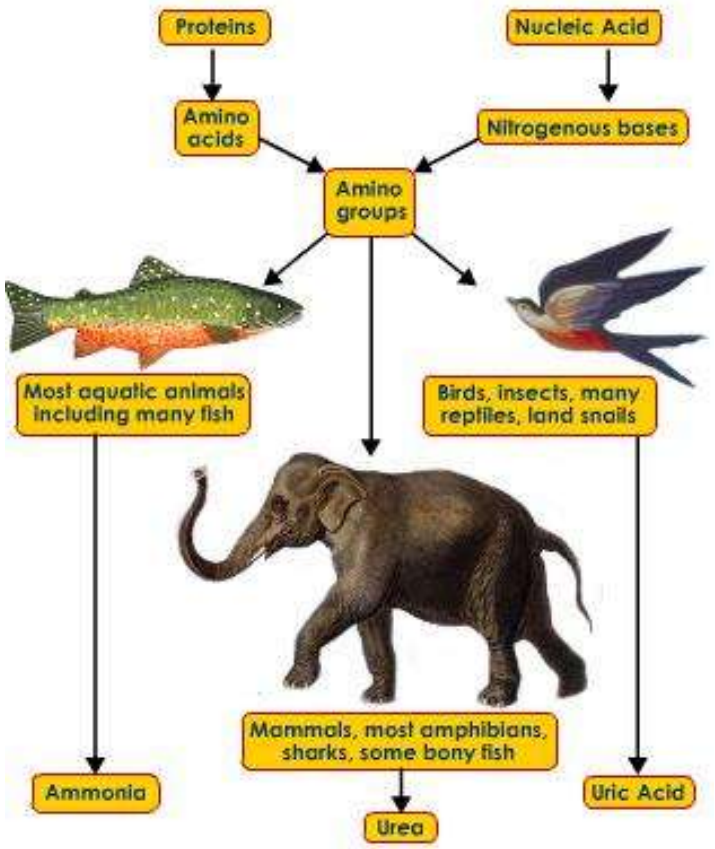
- Fever
- Hibernation
- Torpor
- thermogenesis
- Endotherm
- Ectotherm
- Evaporation

- convection
- Conduction
- Positive feedback
- Negative feedback
- Dynamic equilibrium
- Stimulus
- Response
- Sensor

Lecture #19 Date_____

- Chapter 44 ~ *Regulating the Internal Environment*

QOD



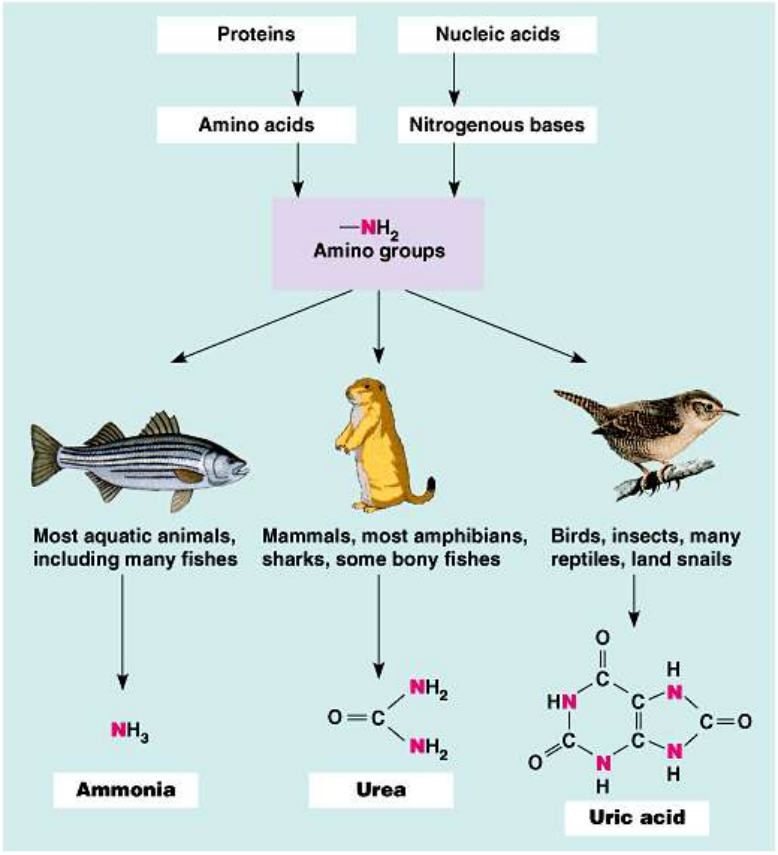
- Nitrogenous waste can be excreted in several forms. List three and give the evolutionary purpose that it serves while explaining what animal might excrete this waste.

Homeostasis: regulation of internal environment

- Thermoregulation internal temperature
- Osmoregulation solute and water balance
- Excretion nitrogen containing waste

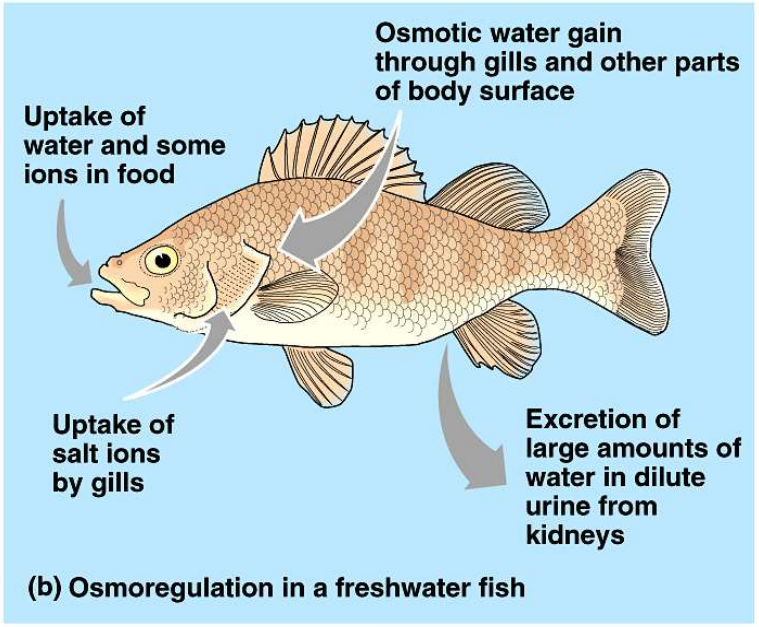
Water balance and waste disposal

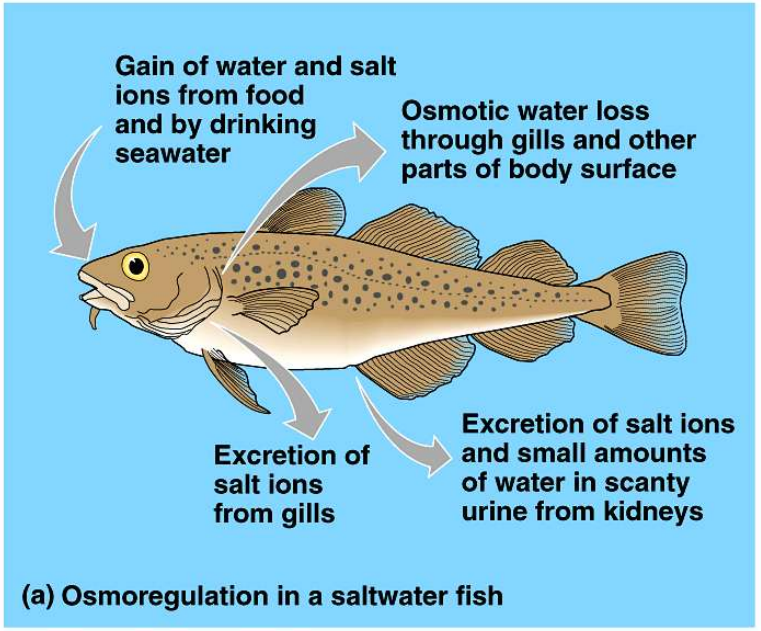
- Osmoregulation:
  management of the body's water content and solute composition
- Nitrogenous wastes: breakdown products of proteins and nucleic acids; ammonia-very toxic
- Deamination~
- Ammonia: most aquatic animals, many fish
- Urea: mammals, most amphibians, sharks, bony fish (in liver; combo of NH_3 and CO_2)
- Uric acid: birds, insects, many reptiles, land snails



Osmoregulators

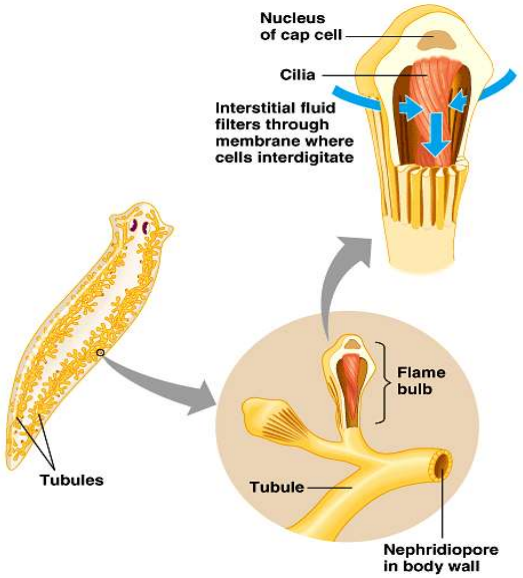
- Osmoconformer: no active adjustment of internal osmolarity (marine animals); isoosmotic to environment
- Osmoregulator: adjust internal osmolarity (freshwater, marine, terrestrial)
- Freshwater fishes (hyperosmotic)- gains water, loses; excretes large amounts of urine salt vs. marine fishes (hypoosmotic)- loses water, gains salt; drinks large amount of saltwater

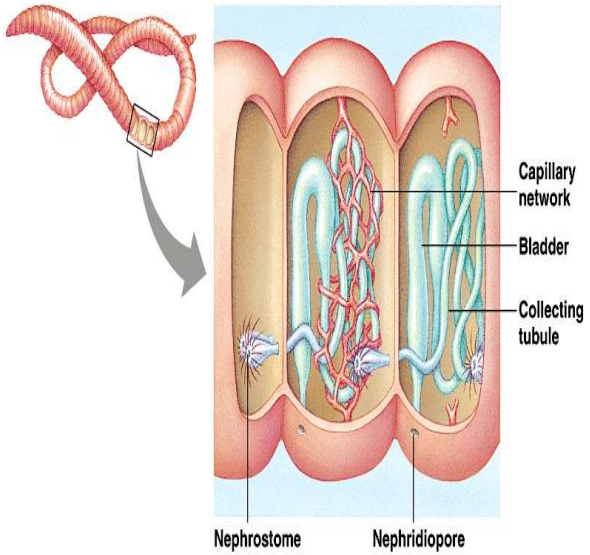


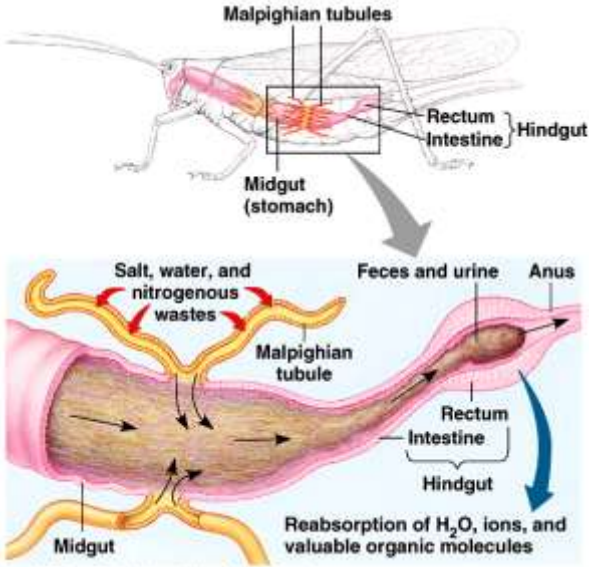


Excretory Systems

- Production of urine by 2 steps: • Filtration (nonselective) • Reabsorption (secretion of solutes)
- Protonephridia ~ flatworms (“flame-bulb” systems)
- Metanephridia ~ annelids (ciliated funnel system)
- Malpighian tubules ~ insects (tubes in digestive tract)
- Kidneys ~ vertebrates

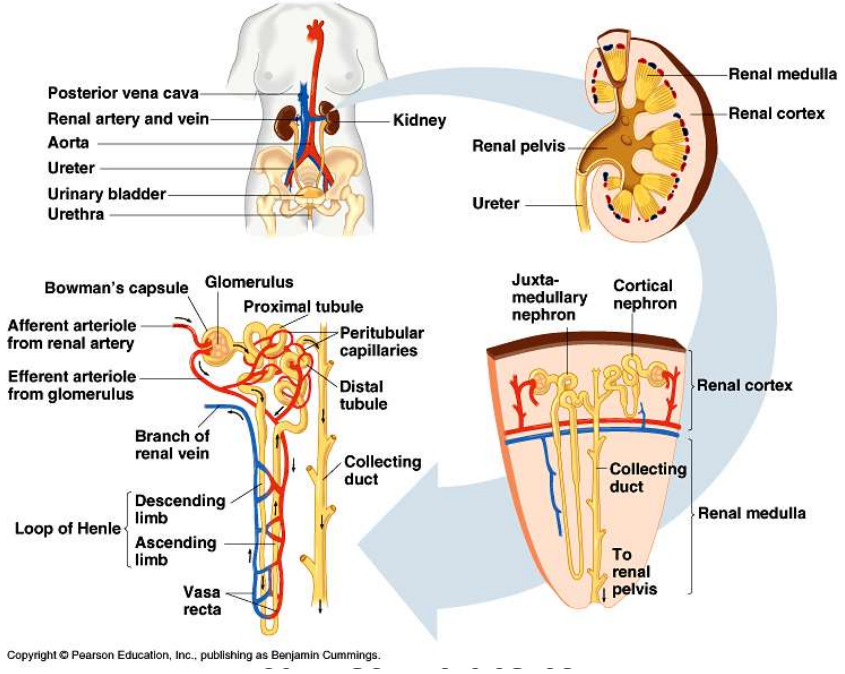






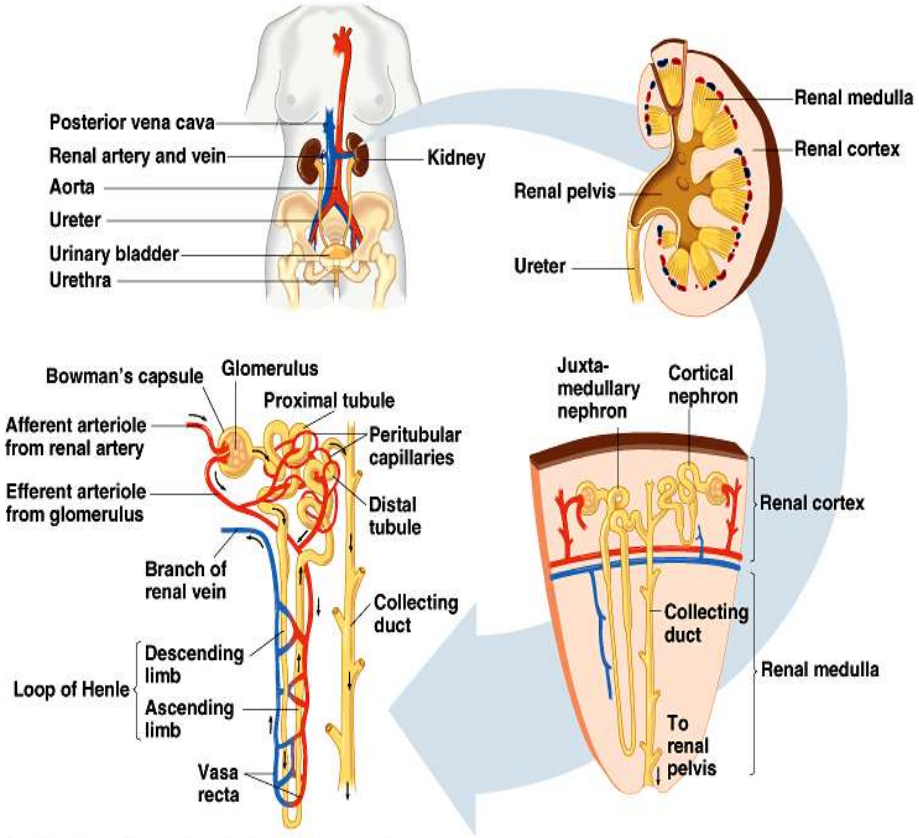
Nephron Structure

- Afferent arteriole: supplies blood to nephron from renal artery
- Glomerulus: ball of capillaries
- Efferent arteriole: blood from
- Bowman's capsule: glomerulus
- Proximal tubule: reabsorption
- Peritubular capillaries: efferent arteriole; tubules
- Loop of Henle: water & salt balance
- Distal tubule: secretion & reabsorption
- Collecting duct: renal pelvis



Kidney Functional Units

- Renal artery/vein: kidney blood flow
- Ureter: urine excretory duct
- Urinary bladder: urine storage
- Urethra: urine elimination tube
- Renal cortex (outer region)
- Renal medulla (inner region)
- Nephron: functional unit of kidney
- Cortical nephrons (cortex; 80%)
- Juxtamedullary nephrons (medulla; 20%)



Kidney regulation: hormones

- **Antidiuretic hormone (ADH)** ~ secretion increases permeability of distal tubules and collecting ducts to water (H2O back to body); inhibited by alcohol and coffee
- **Juxtaglomerular apparatus (JGA)** ~ reduced salt intake--->enzyme renin initiates conversion of angiotension (plasma protein) to angiotension II (peptide); increase blood pressure and blood volume by constricting capillaries
- **Angiotension II** also stimulates adrenal glands to secrete aldosterone; acts on distal tubules to reabsorb more sodium, thereby increasing blood pressure (renin-angiotension-aldosterone system; RAAS)
- **Atrial natriuretic factor (ANF)** ~ walls of atria; inhibits release of renin, salt reabsorption, and aldosterone release