

Chapter 40 Animal Physiology and Homeostasis



Animal Form and Function

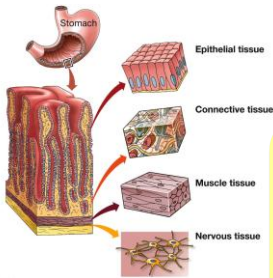
- Animals provide examples of biology's major themes
 - ♦ diversity & unity of life
 - ♦ form & function are interwoven
 - ♦ evolution is the thread that ties it all together
 - adaptations observed in a comparative study of animals evolved by natural selection

The cold-adapted rabbit has short ears and extremities to reduce heat lost, while the heat-adapted jackrabbit has longer ears that act as heat exchangers with ambient air.



Hierarchy of Structure

- cells → tissues → organs → organ systems



- tissues = groups of cells with common structure and function
- organs = composed of different tissue types
- organ systems = organs working towards the same function

Tissue Types

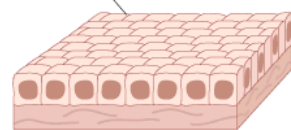
- Epithelial
 - ♦ covers body surfaces & lines internal body cavities
 - ♦ skin, mucous membranes, lining of digestive tract
- Muscle
 - ♦ body movement
 - ♦ skeletal, cardiac, smooth muscle
- Connective
 - ♦ framework of body
 - ♦ bone, cartilage, fibers, blood
- Nervous
 - ♦ integration & control of response to stimuli
 - ♦ neurons and glial cells

Epithelial Tissue

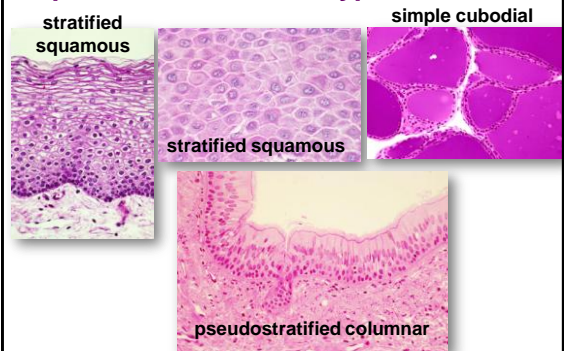
▪ Functions

- ♦ lining, protecting & forming glands
- ♦ protection of internal environment against external environment
- ♦ secretion of a product

Layer of cuboid epithelial (skin) cells

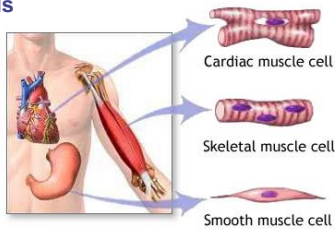


Epithelial Tissue Cell Types



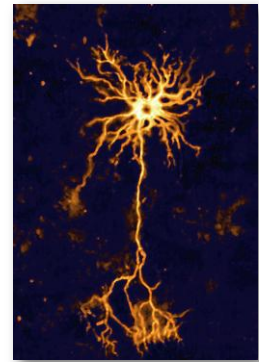
Muscle Tissue

- **Functions**
 - ◆ facilitates movement by contraction of muscle cells (fibers)
- **Types**
 - ◆ skeletal
 - (striated)
 - ◆ cardiac
 - ◆ smooth



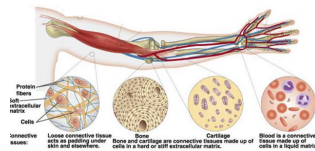
Nervous Tissue

- **Functions**
 - ◆ integrating stimuli
 - ◆ response to stimuli
- **Types**
 - ◆ neurons
 - brain and spinal cord
 - ◆ glial cells

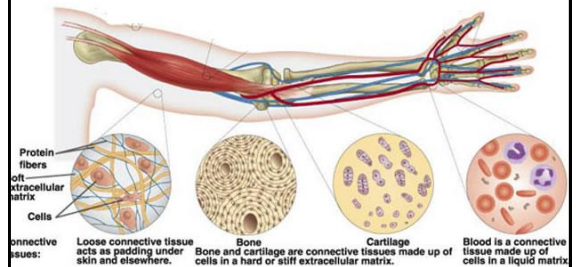


Connective Tissue

- **Functions**
 - ◆ support & binding
 - ◆ blood
 - ◆ storing fats
 - ◆ filling space
- **Types**
 - ◆ bone
 - ◆ blood
 - ◆ fibers
 - ◆ cartilage
 - ◆ adipose (fat)



Connective Tissue

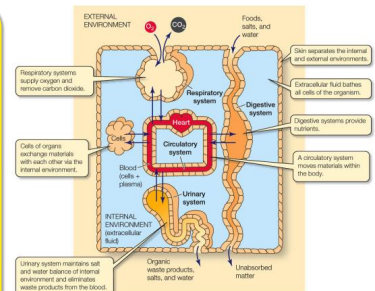
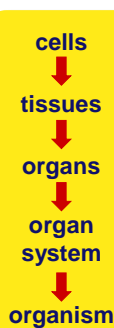


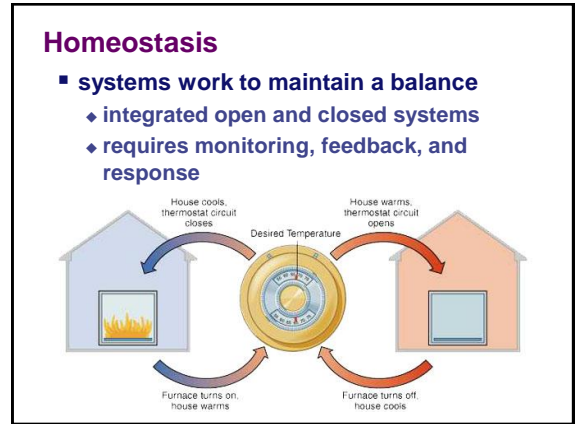
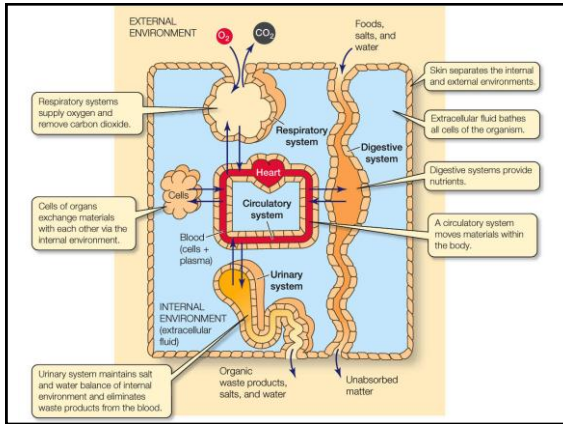
Cartilage and Bone

- **Rigid connective tissues**
 - ◆ structural proteins deposited in matrix between cells
 - ◆ bone is stronger
 - strength from calcium salts deposited in matrix
 - ◆ calcium reservoir
 - ◆ cartilage is softer
 - forms embryonic skeleton of vertebrates & adult skeleton of sharks and rays
 - in human body = ears, tip of nose & at joints



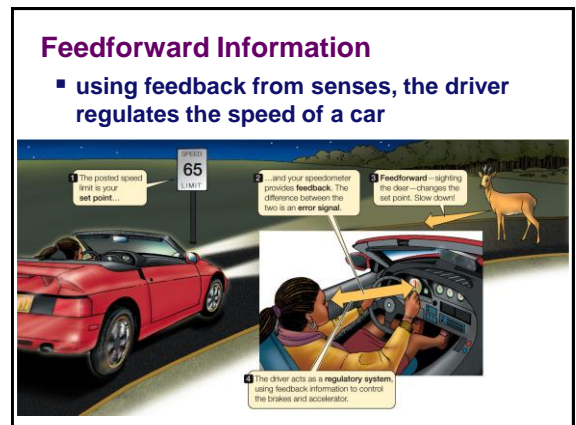
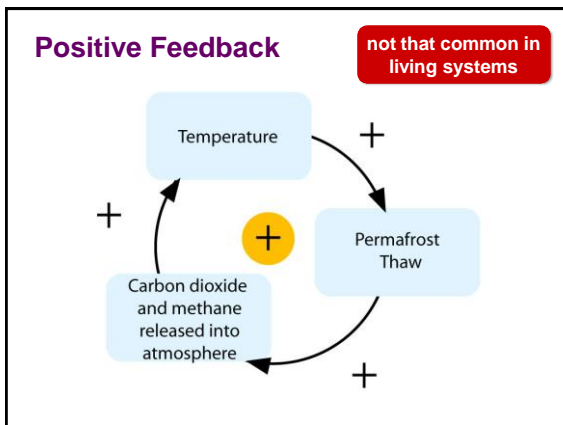
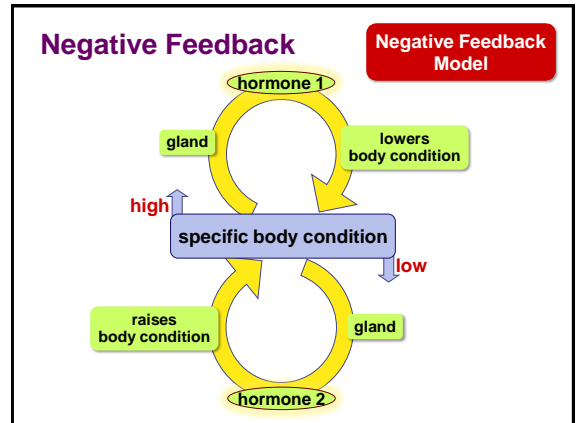
Organ Systems





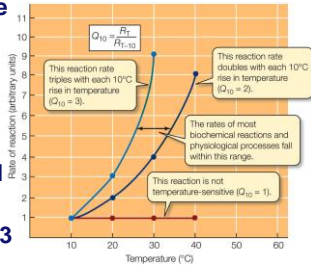
Feedback Circuits

- Negative feedback**
 - stimulus triggers control mechanism counteracting further change
 - reverse effect
- Positive feedback**
 - stimulus triggers control mechanism amplifying effect
 - much less common
- Feedforward information**
 - changing the set point at which the desired equilibrium should be



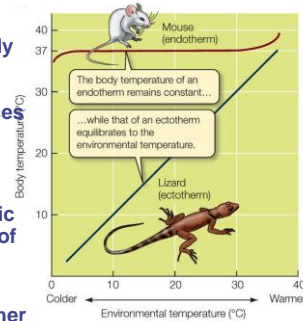
Q₁₀

- the temperature sensitivity of a reaction or process
- = R_T/R_{T-10}
- most biological Q₁₀ values are between 2 and 3



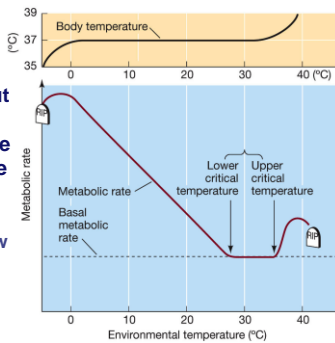
What -therm are you?

- **ectotherm**
 - ♦ animals whose body temperature are determined by external heat sources
- **endotherm**
 - ♦ regulate body temperature by producing metabolic heat or prevention of heat loss
- **heterotherm**
 - ♦ can behave like either
 - hibernating mammals

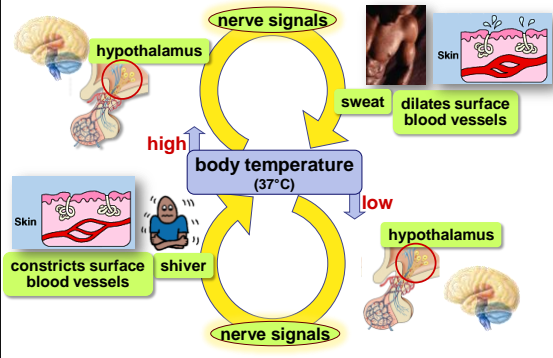


BMR (Basal Metabolic Rate)

- measured when a resting animal is consuming just enough to carry out its minimal life functions within the thermoneutral zone
 - ♦ when the metabolic rate of endotherms is low and independent of temperature



Controlling Body Temperature



Any Questions?