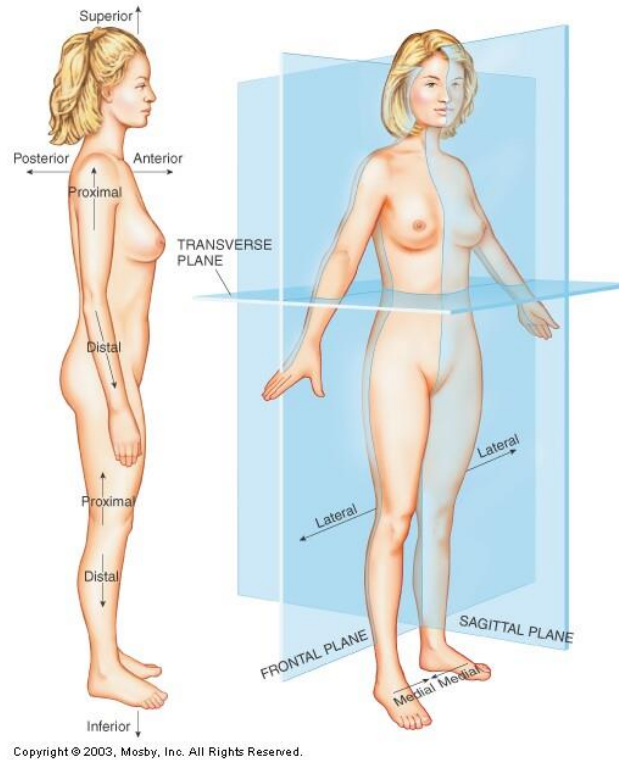


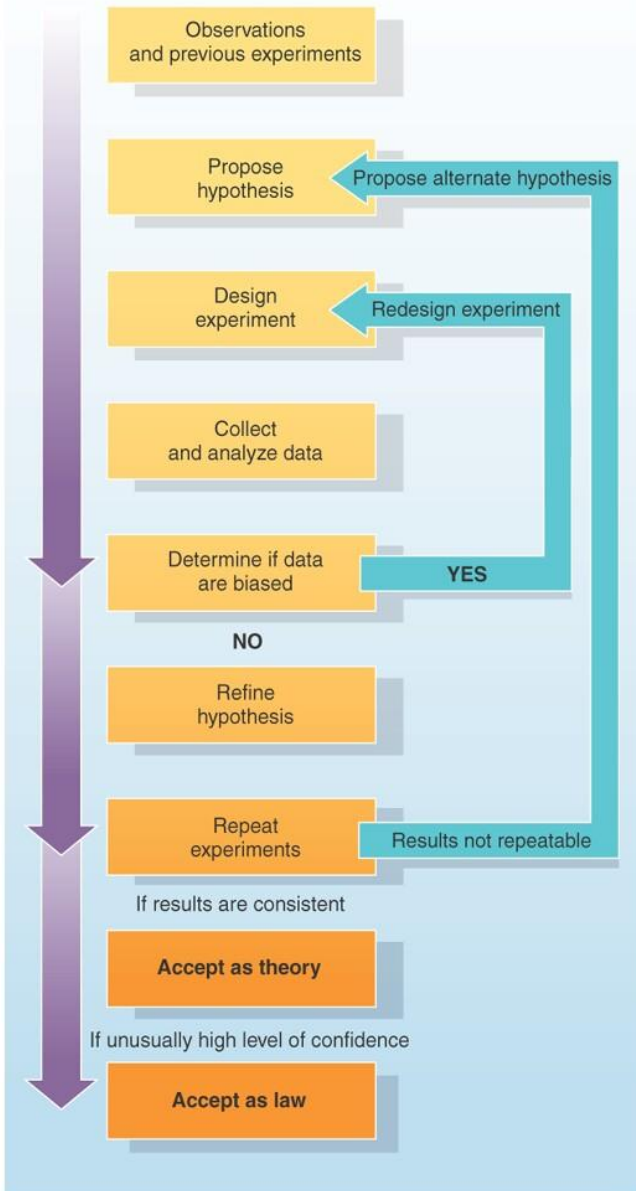
Organization of the Body

Chapter 1



Anatomy & Physiology
Ms. Roden

The Scientific Method



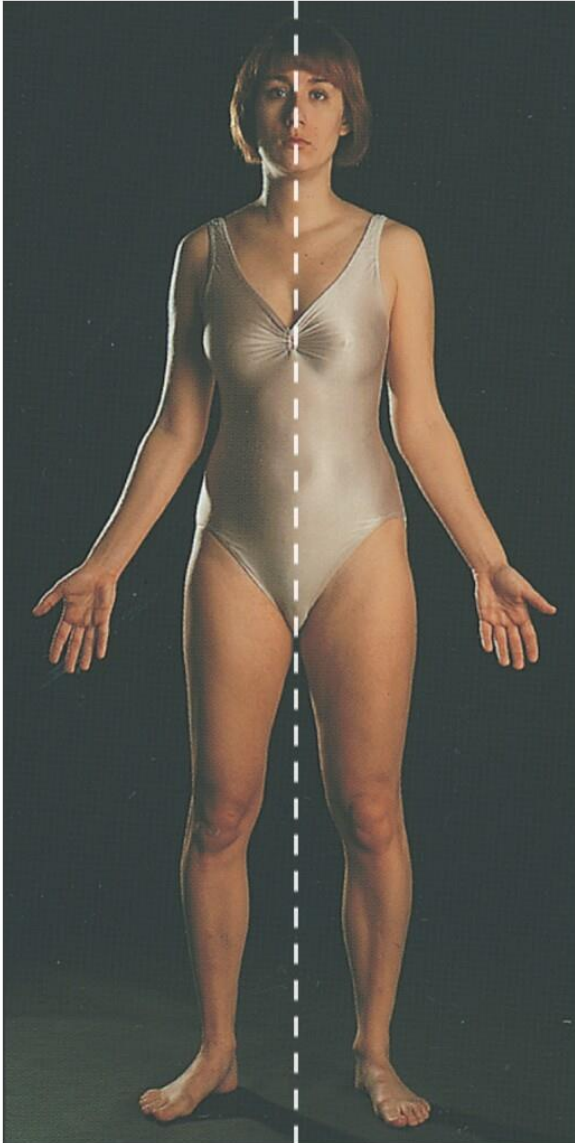
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Andreas Vesalius – founder of modern anatomy

Woodcut of a gross dissection

In world's first anatomy textbook in 1543

Anatomical Position/Bilateral Symmetry



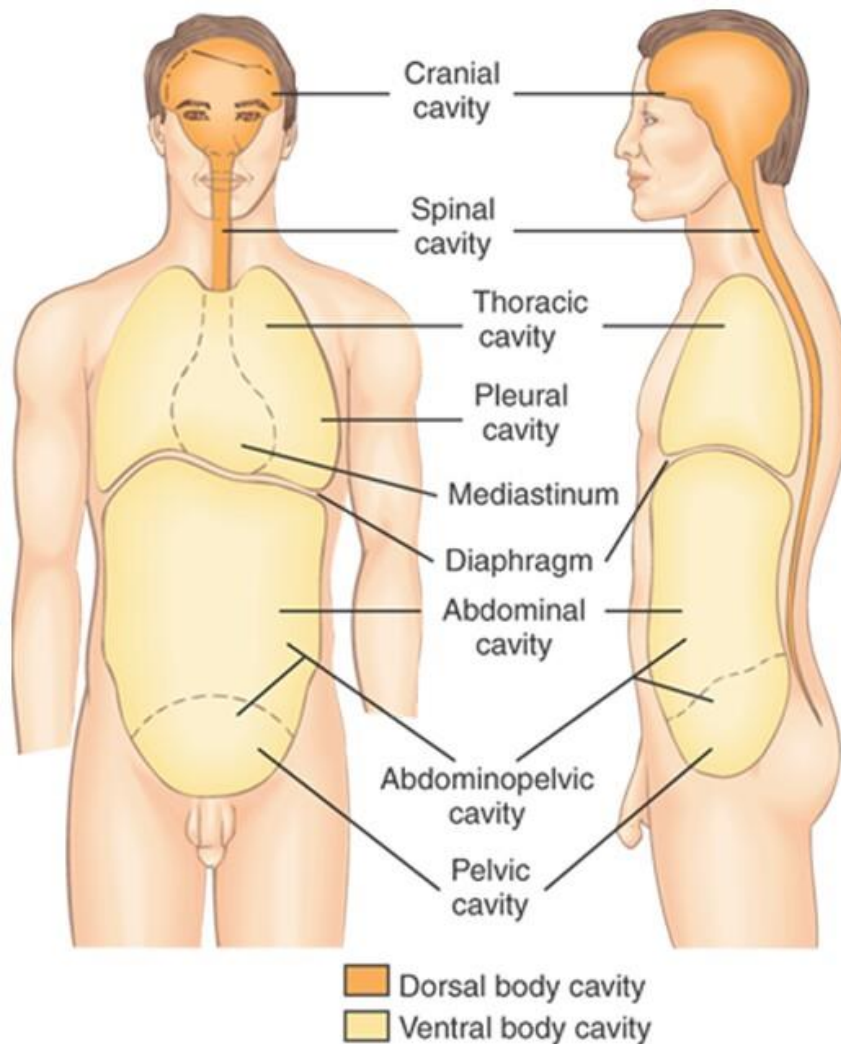
Anatomical Position – erect; palms, head and feet forward

Bilateral symmetry – right and left sides are mirror images

Ipsilateral – same side

Contralateral – opposite side

Body Cavities



- A. Posterior/Dorsal (back)
 - 1. Cranial
 - 2. Spinal

- B. Anterior/Ventral (front)
 - 1. Thoracic
 - a. Mediastinum
 - b. Pleural
 - 2. Abdominopelvic
 - a. Abdominal
 - b. Pelvic

Body Cavities

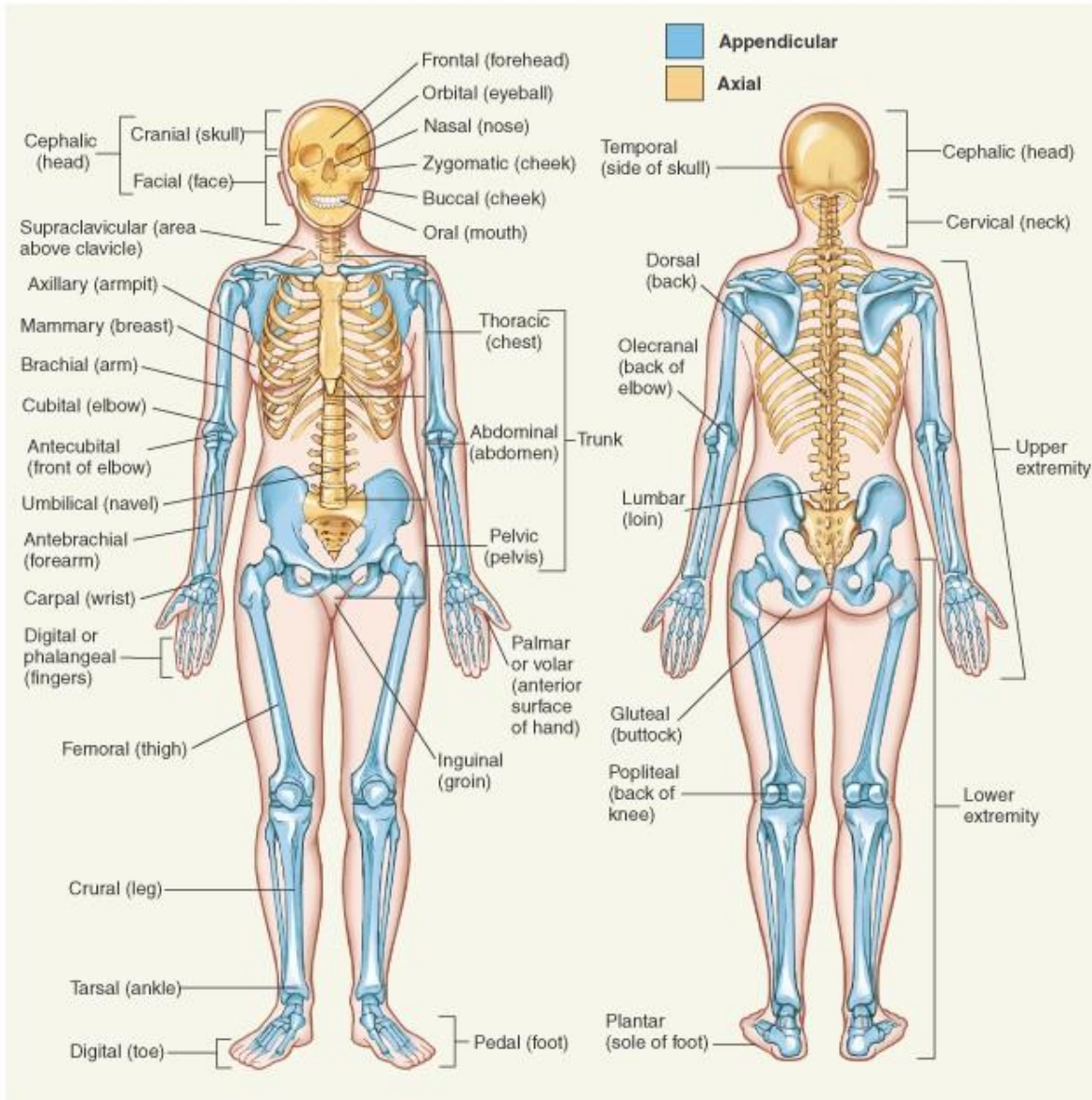
Parietal – wall of a body cavity or lining membrane that covers the surface

parietal peritoneum – membrane lining the inside of the abdominal cavity

Visceral – thin membrane that covers the organs within a cavity

visceral peritoneum – membrane that covers the organs within the abdominal cavity

Body Regions



Axial – head, neck, torso/trunk

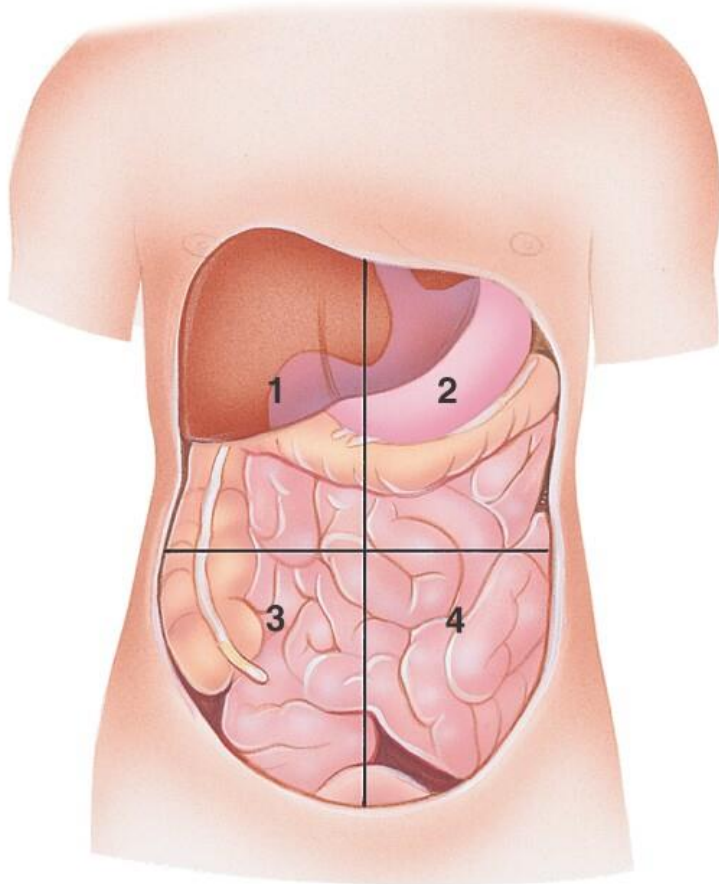
Appendicular – extremities

- Abdominal
- Axillary
- Brachial
- Antebrachial
- Carpal
- Digital
- Cephalic
- Cervical
- Inguinal
- Pelvic
- Pubic
- Thoracic
- Gluteal
- Lumbar
- Occipital

Abdominopelvic Regions

4 Quadrants

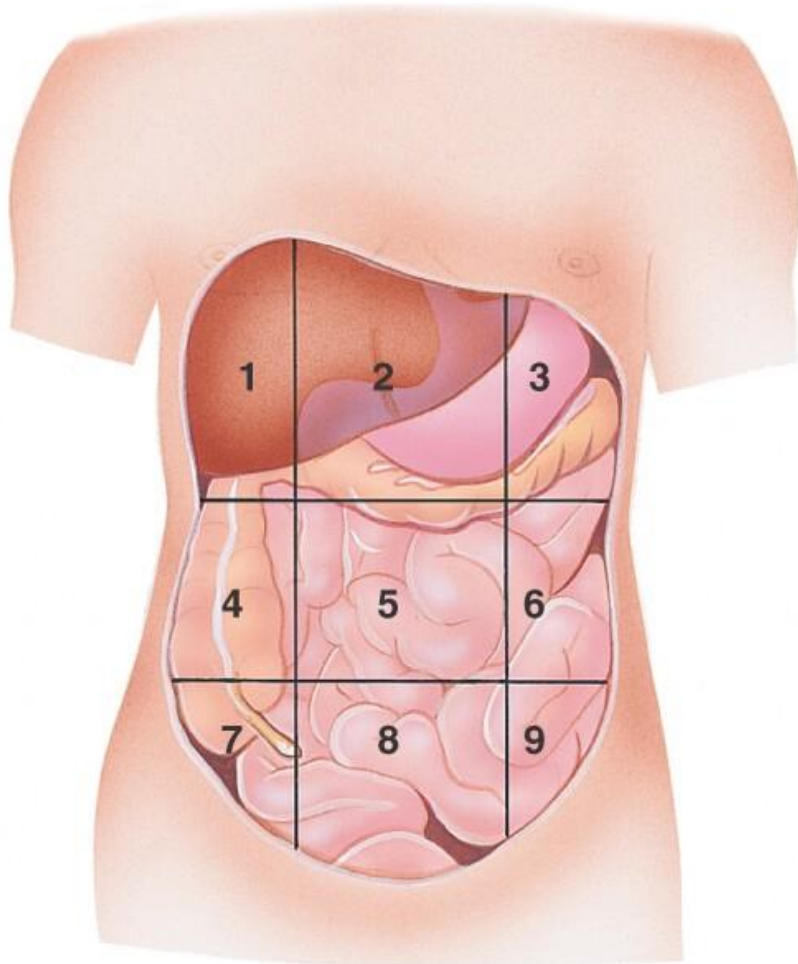
Doctors divide torso into quadrants to describe the site of pain and/or locate internal pathology (tumor)



1. Right upper quadrant (RUQ)
2. Left upper quadrant (LUQ)
3. Right lower quadrant (RLQ)
4. Left lower quadrant (LLQ)

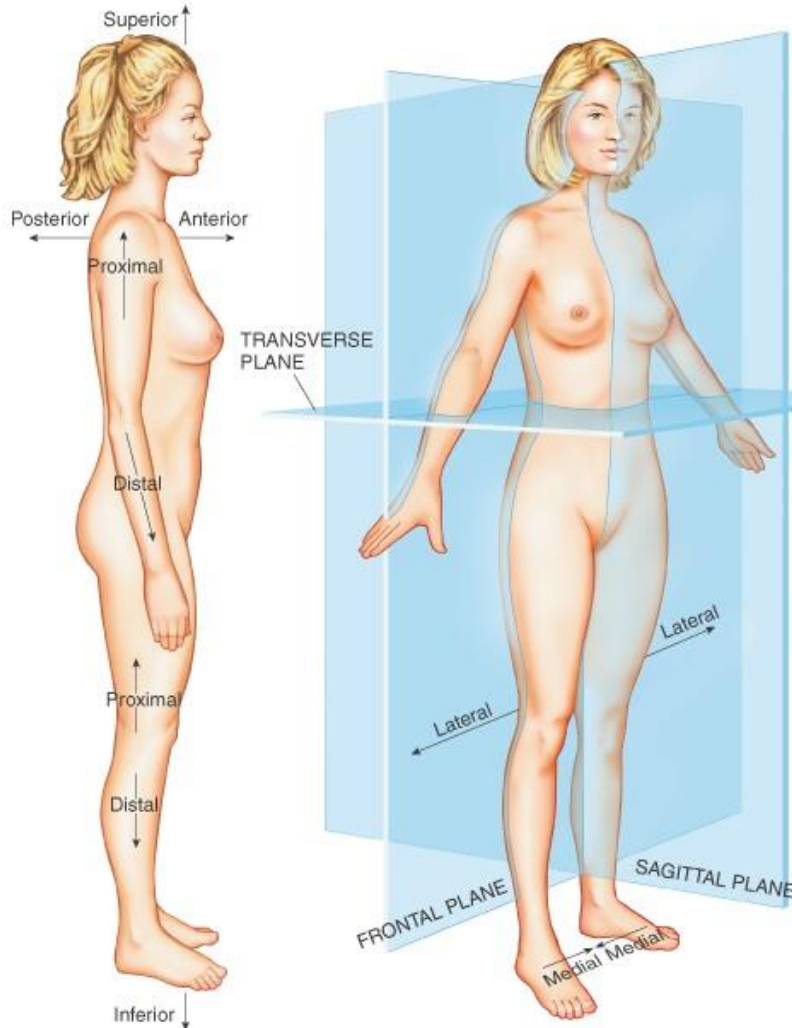
Abdominal Regions

Superficial Organs



1. Right hypochondriac – right lobe of liver, gallbladder
2. Epigastric – right and left lobes of liver, stomach
3. Left hypochondriac – stomach, large intestine
4. Right lumbar – large and small intestine
5. Umbilical – transverse colon, small intestine
6. Left lumbar – small intestine, colon
7. Right iliac – cecum, small intestine
8. Hypogastric – small intestine, bladder, appendix
9. Left iliac – colon, small intestine

Directional Terms



Superior – toward the head

Inferior – toward the feet

Anterior/ventral – front

Posterior /dorsal– back

Medial – toward the midline

Lateral – toward the side/away from midline

Proximal – toward or nearest the trunk or point of origin

Distal – away from or farthest from trunk or point of origin

Superficial – nearest the surface

Deep – farther away from surface

Body Planes

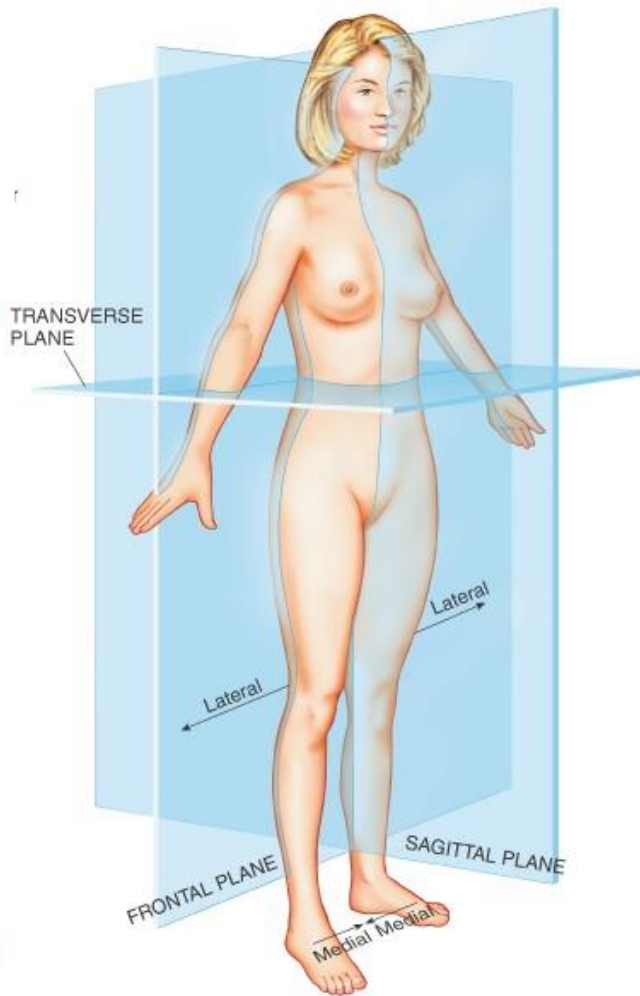
Sagittal – lengthwise, front to back, divides body into left and right sides,
* **Midsagittal** (sagittal section in middle)

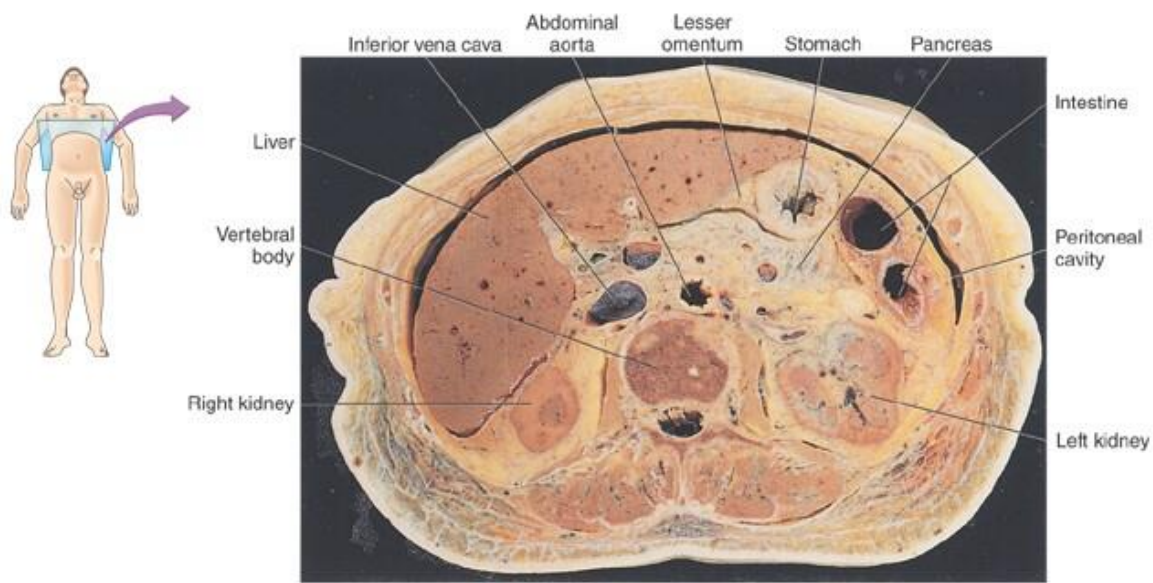
Coronal/Frontal – lengthwise, side to side, divides body into anterior and posterior portions; frontal plane

Transverse – crosswise, divides body or parts into upper and lower parts; horizontal plane

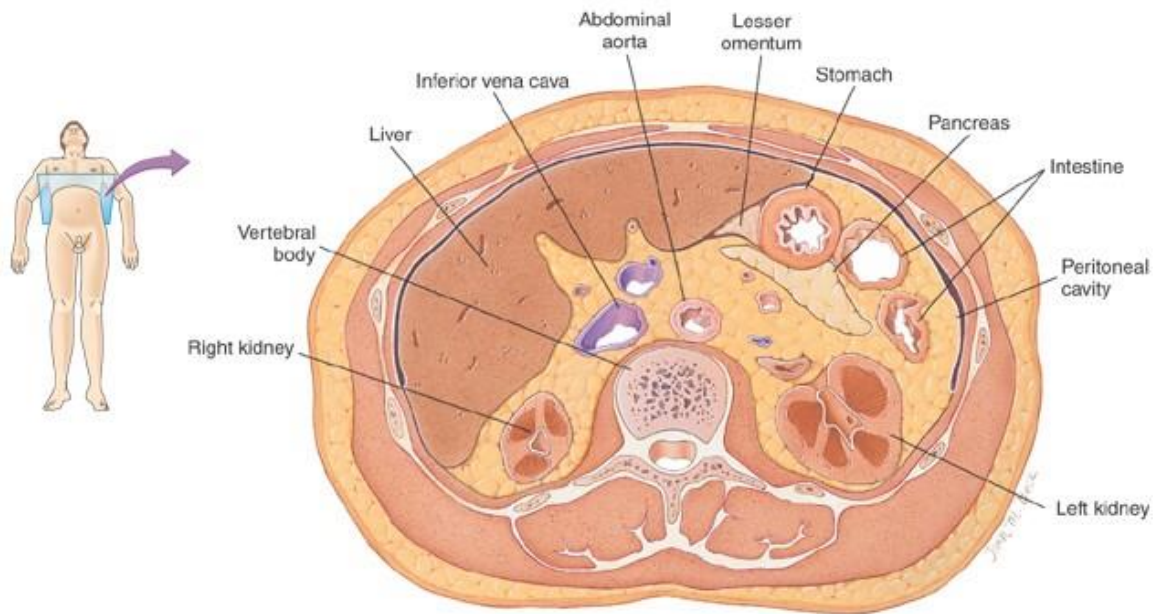
Compass Rosett

A	anterior
D	distal
I	inferior
L (opposite M)	lateral
L (opposite R)	left
M	medial
P (opposite A)	posterior
P (opposite D)	proximal
R	right
S	superior





Transverse Cut



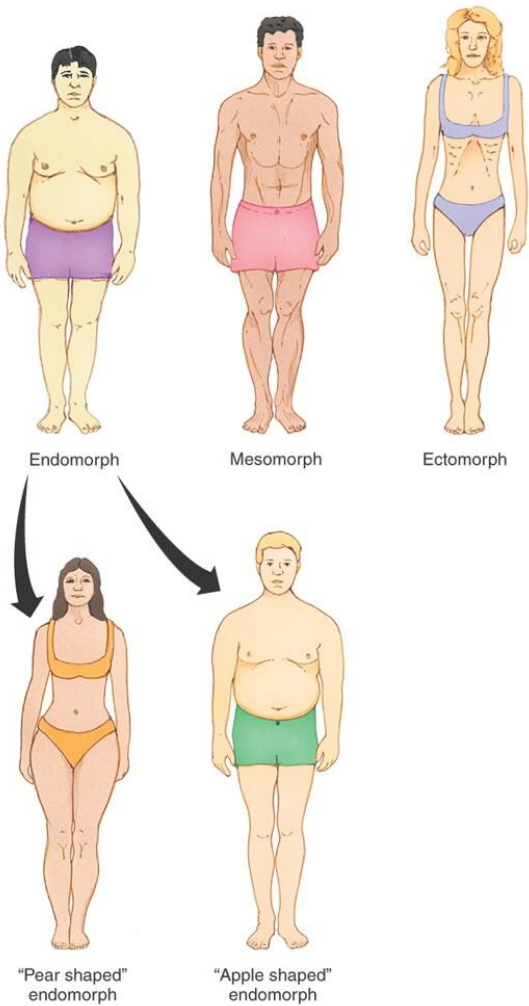
Interaction of Structure and Function

Complementarity of structure and function – structure determines function; function influences anatomy of organism over time.

DNA example:

- DNA directs the differentiation of specialized cells in the lungs during development to effectively contribute to respiratory function
- DNA activity produces special chemicals, modifies cells, and tissues appear that are unique to organ system

Body Type and Disease



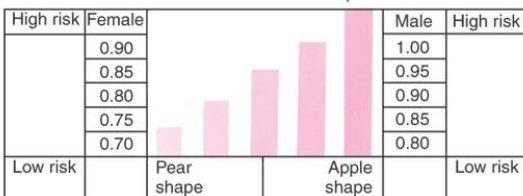
Somatotype – describes a particular category of body build or physique; researchers have found types associated with disease

- Endomorph – heavy, rounded, large amount of fat in trunk and thighs

“apple-shaped” – heart disease, stroke, high blood pressure, diabetes, post-menopausal breast cancer

- Mesomorph – muscular
- Ectomorph – thin, fragile, little body fat

Health Risk for Endomorphs



Waist-to-hip ratio: waist /hip
male >1/women >0.9 = high disease risk

Characteristics of Life

1.Responsiveness

- a. permits an organism to sense, monitor, and respond to changes in its external environment
- b. highly developed in nerve and muscle cells

2.Conductivity

- a. capacity of living cells and tissues to selectively transmit or propagate a wave of excitation from one point to another within the body
- b. highly developed in nerve and muscle cells

3.Growth

- a. normal increase in size or number of cells
- b. produces an increase in size (person, organ, part)
- c. little change in the shape

4.Respiration

- a. Involves processes in absorption, transport, utilization, or exchange of respiratory gases between an organism and its environment
- b. Internal vs. external

5.Digestion

- a. Complex food products are broken down into simpler substances that can be absorbed and used by organism

6.Absorption

- a. Movement of digested nutrients through the wall of the digestive tube and into body fluids for transport to cells

Characteristics of Life

7. Secretion

- a. Production and delivery of specialized substances (digestive juices, hormones) for diverse body functions

8. Excretion

- a. Removal of wastes produced during body functions (breakdown and use of nutrients in the cell)

9. Circulation

- a. Movement of body fluids and many other substances (nutrients, hormones, waste products) from one body area to another

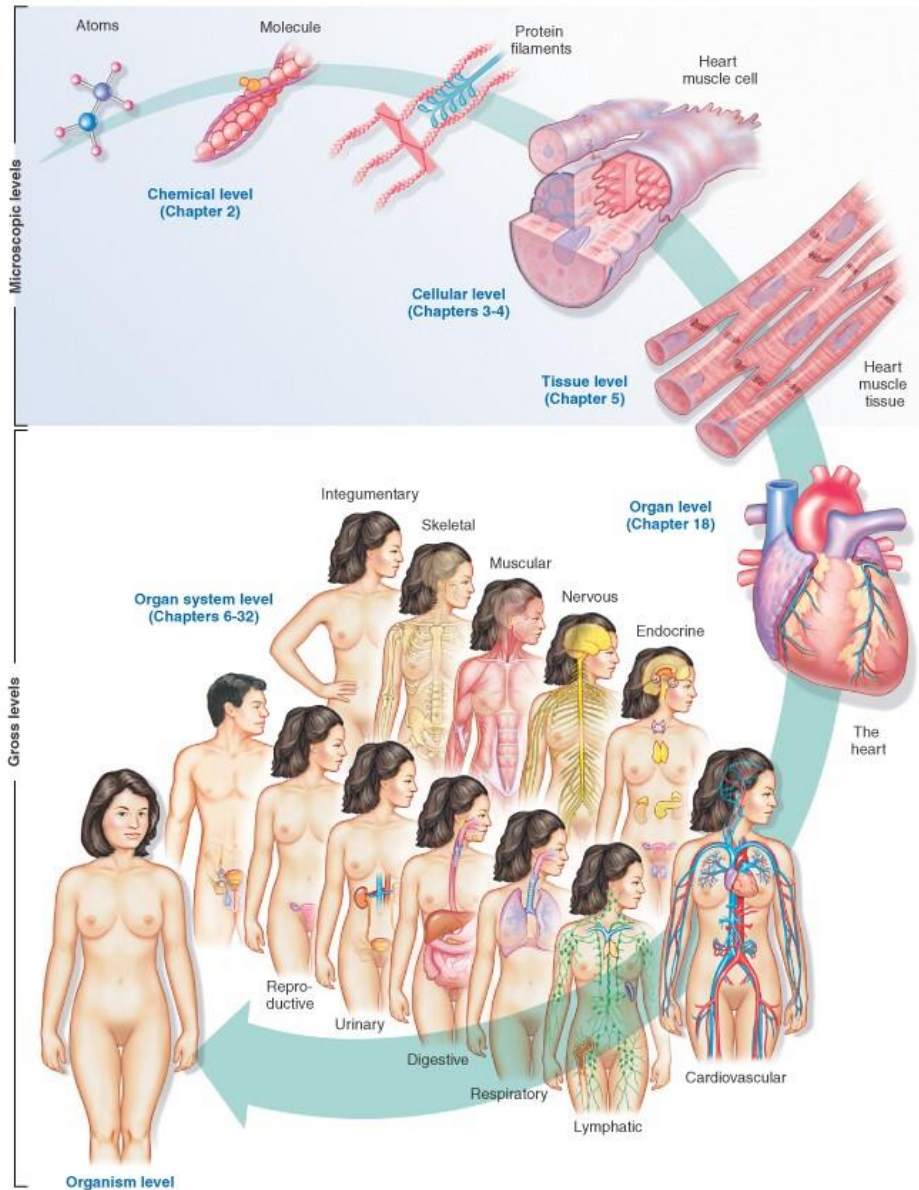
10. Reproduction

- a. Formation of new individual and new cells (cell division)
- b. Permits growth, wound repair, and replacement of dead/aging cells

Metabolism – describes the various processes by which life is made possible

- breakdown of nutrients
- produce energy
- transform one material into another
- required to make complex cpds out of simple cpds

Levels of Organization



Levels of Organization (Hierarchy)

1. Chemical

- a. Basis for life
- b. More than 100 different atoms (chemical building blocks of nature)
- c. **Atoms → molecules → macromolecules**
- d. Cytoplasm – essential material of human life

2. Organelle

- a. A structure made of molecules organized so that it can perform a certain function
- b. Can not survive outside the cell
- c. “tiny organs” that allow each cell to live

3. Cellular

- a. Cells – smallest and most numerous structural units that possess and exhibit the basic characteristics of living matter
- b. 150 lb adult - 1×10^{14} cells (100 trillion)
- c. Membrane, nucleus, cytoplasm, organelles
- d. Cells specialize/differentiate to perform unique functions

4. Tissue

- a. Group of similar cells that develop together from the same part of the embryo
- b. Specialized to perform certain functions
- c. Surrounded by varying amounts and kinds of nonliving, intercellular substances, or matrix
- d. Four major tissues
 1. epithelial
 2. connective
 3. muscle
 4. nervous

Levels of Organization: Hierarchy

5. Organ

- a. Structure made up of several different kinds of tissues to perform a certain function
- b. Each one has unique shape, size, appearance, and placement in the body
- c. Identified by tissue pattern that forms it

6. System

- a. Most complex organizational unit of the body
- b. Involves varying numbers and kinds of organs to perform complex functions
- c. 11 major systems (integumentary, skeletal, muscular, nervous, endocrine, circulatory, lymphatic/immune, respiratory, digestive, urinary, reproductive)

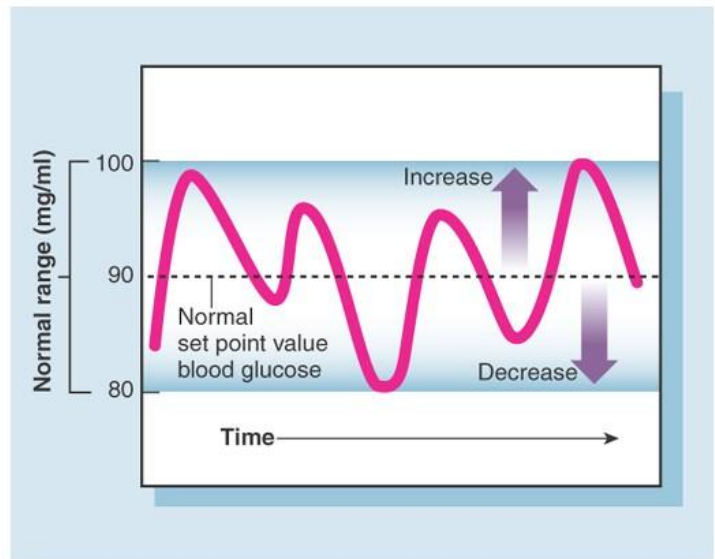
7. Organism

- a. Interactive structures able to survive in hostile environments
- b. Permit homeostasis

Atoms → molecules → macromolecules → organelles → cells → tissues → organs → organ systems → organism

Homeostasis

- A *relatively constant* state maintained by the body
- Ability of the body to maintain its internal environment (cellular environment) as the external environment constantly changes
- Internal environment (ie. body temp, pH, glucose level)
- External environment (ie. Weather, fluid surrounding cells)
- Every regulatory mechanism of the body exists to maintain homeostasis of the body's internal fluid environment
- Set point/set point range – normal reading or range
ie. 80-100 mg glucose / mL blood
body temp 37°C (98.6°F)
- Regulatory mechanisms control homeostasis



Body's Internal Environment

Integumentary system

Separates internal environment from external environment.

Nervous system

Major regulatory system of the internal environment: senses changes, integrates, and sends signals to effectors (muscular organs, glands).

Digestive system

Breaks down nutrients from the external environment and absorbs them into the internal environment.

Respiratory system

Exchanges O_2 and CO_2 between the internal and external environment.

Endocrine system

Regulates internal environment by secreting hormones that travel through the bloodstream to target areas.

Circulatory system

Transports nutrients, water, oxygen, hormones, wastes, and other materials within the internal environment.

Skeletal system

Supports, protects, and moves body. Also stores minerals.

Muscular system

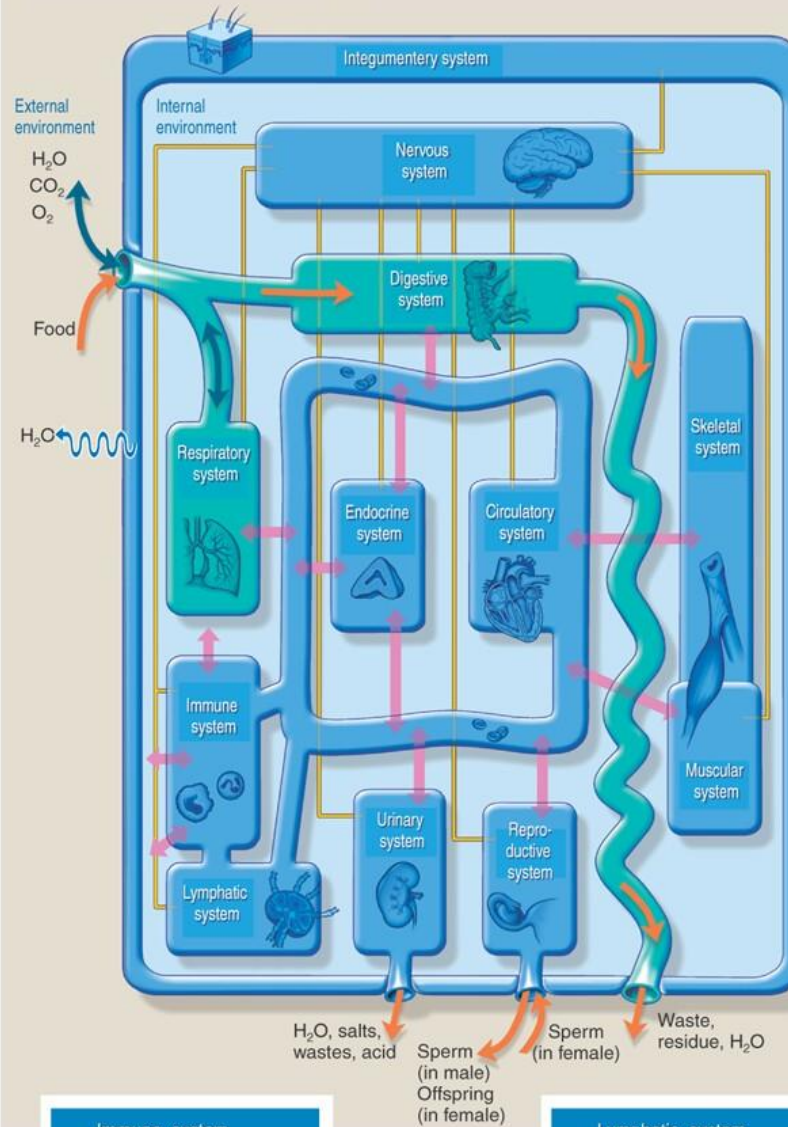
Powers and directs skeletal movement.

Reproductive system

Produces sex cells that form offspring, ensuring survival of genes. Female system is also site of fertilization and early development.

Urinary system

Adjusts internal environment by excreting excess water, salt, and other substances.



Immune system

Defends internal environment against injury from foreign cells and other irritants.

Lymphatic system

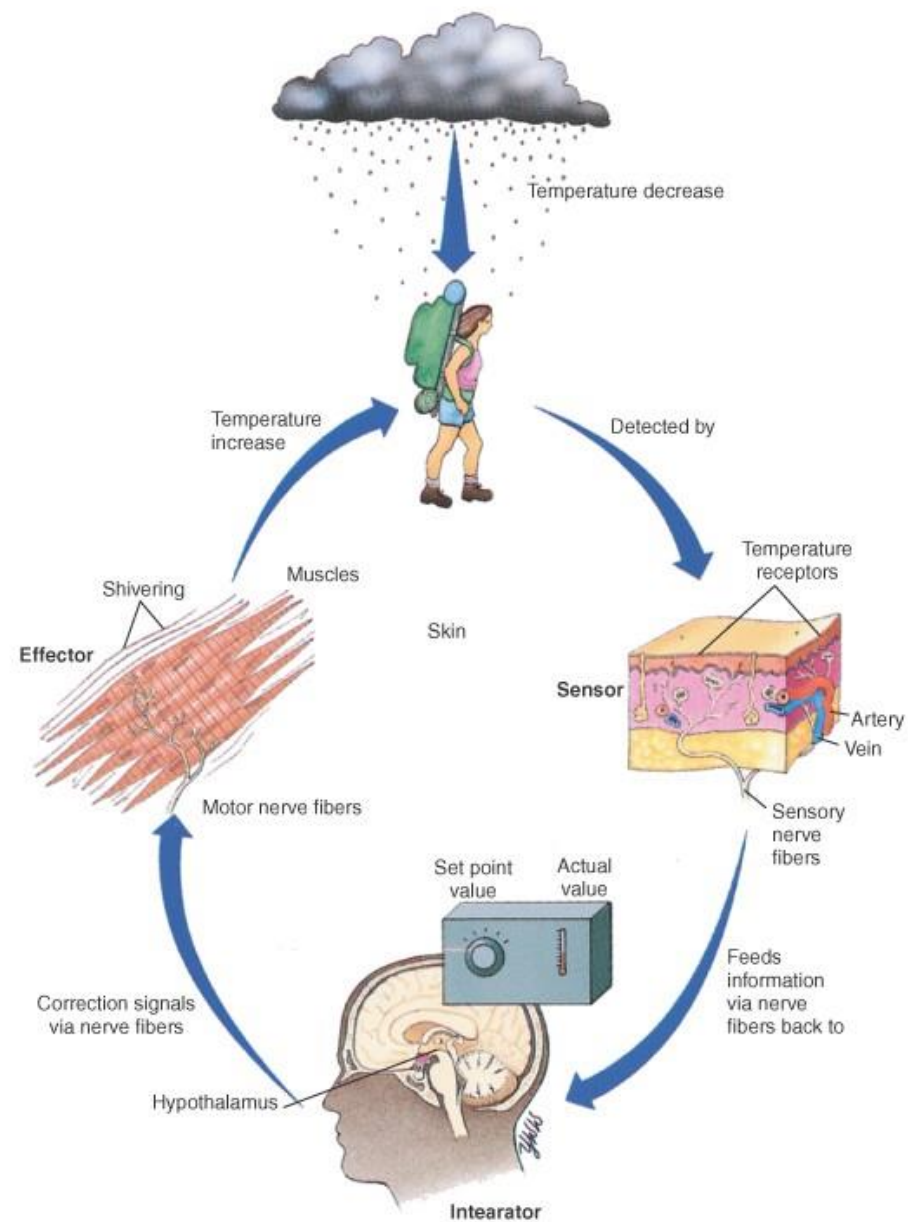
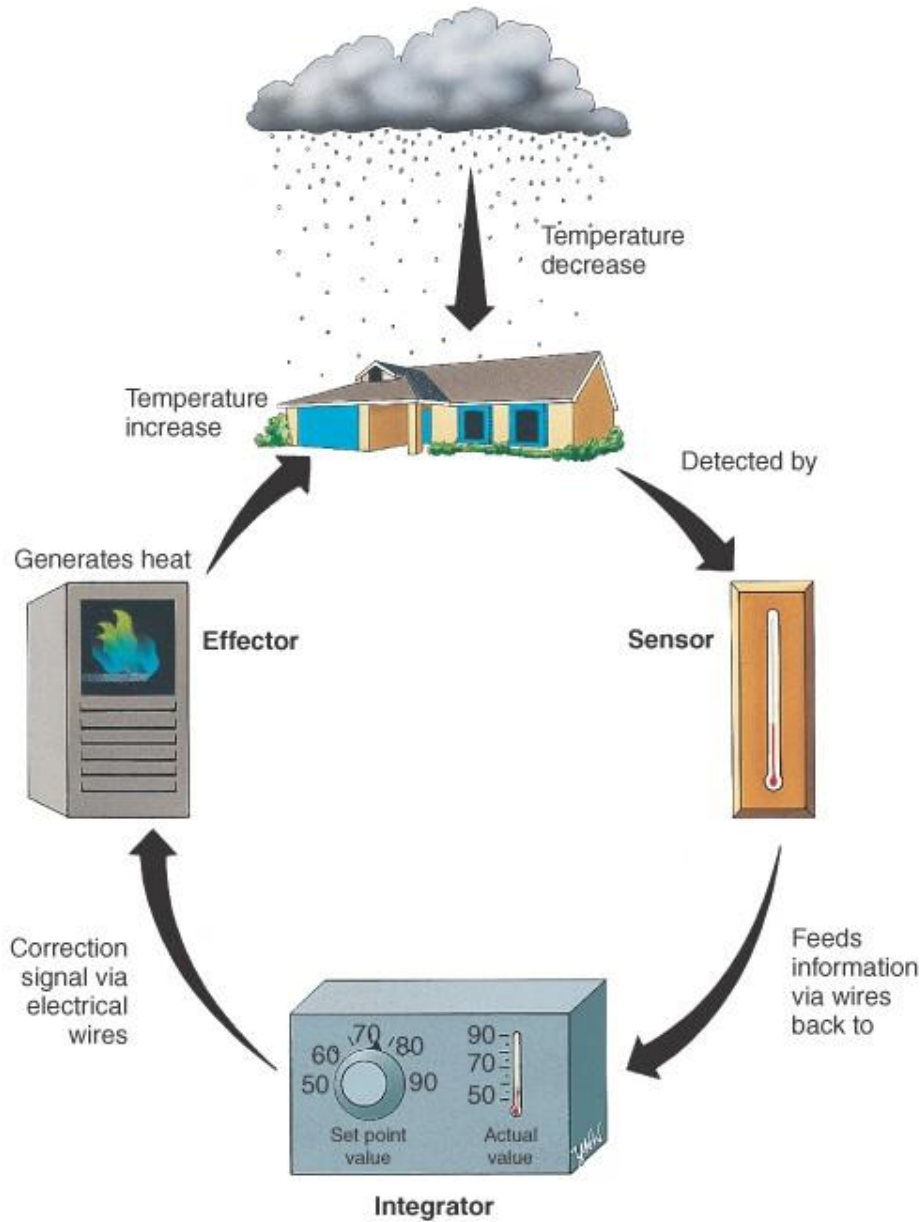
Drains excess fluid from tissues, cleans it, and returns it to the blood.

H_2O , salts, wastes, acid
Sperm (in male)
Offspring (in female)

Sperm (in female)
Waste, residue, H_2O

Homeostatic Control Mechanisms

- Feedback control loop – highly complex and integrated communication control system in order to accomplish self-regulation
ie. blood CO₂ level, temp, heart rate, sleep cycle, thirst
- 4 basic components to every loop:
 1. sensor mechanism (ie. nerve cells, hormone producing glands)
 2. control center (ie. hypothalamus)
 3. effector mechanism (ie. organs)
 4. feedback
- Afferent vs. Efferent
 - Afferent – signal travels toward reference point
 - Efferent – signal travels away from reference point



Negative Feedback	Positive Feedback
<ul style="list-style-type: none"> • Inhibitor 	<ul style="list-style-type: none"> • Stimulatory
<ul style="list-style-type: none"> • Oppose change by creating response opposite in direction of initial disturbance <ul style="list-style-type: none"> change – temperature drop response – heat production initial disturbance – temp fall below normal set point 	<ul style="list-style-type: none"> • Amplifies/reinforces change which can be harmful and disastrous
<ul style="list-style-type: none"> • Stabilize physiological variables 	<ul style="list-style-type: none"> • Cause instability and disrupt homeostasis (continuous temp increase)
<ul style="list-style-type: none"> • Maintain constant internal environment • Ex: goosebumps, sweating 	<ul style="list-style-type: none"> • Ex: sneezing, birth of baby, immune response to infection, blood clot • pg. 25, Box 1-3