



Physiology: Basic concepts

9.1.2024

Learning outcomes

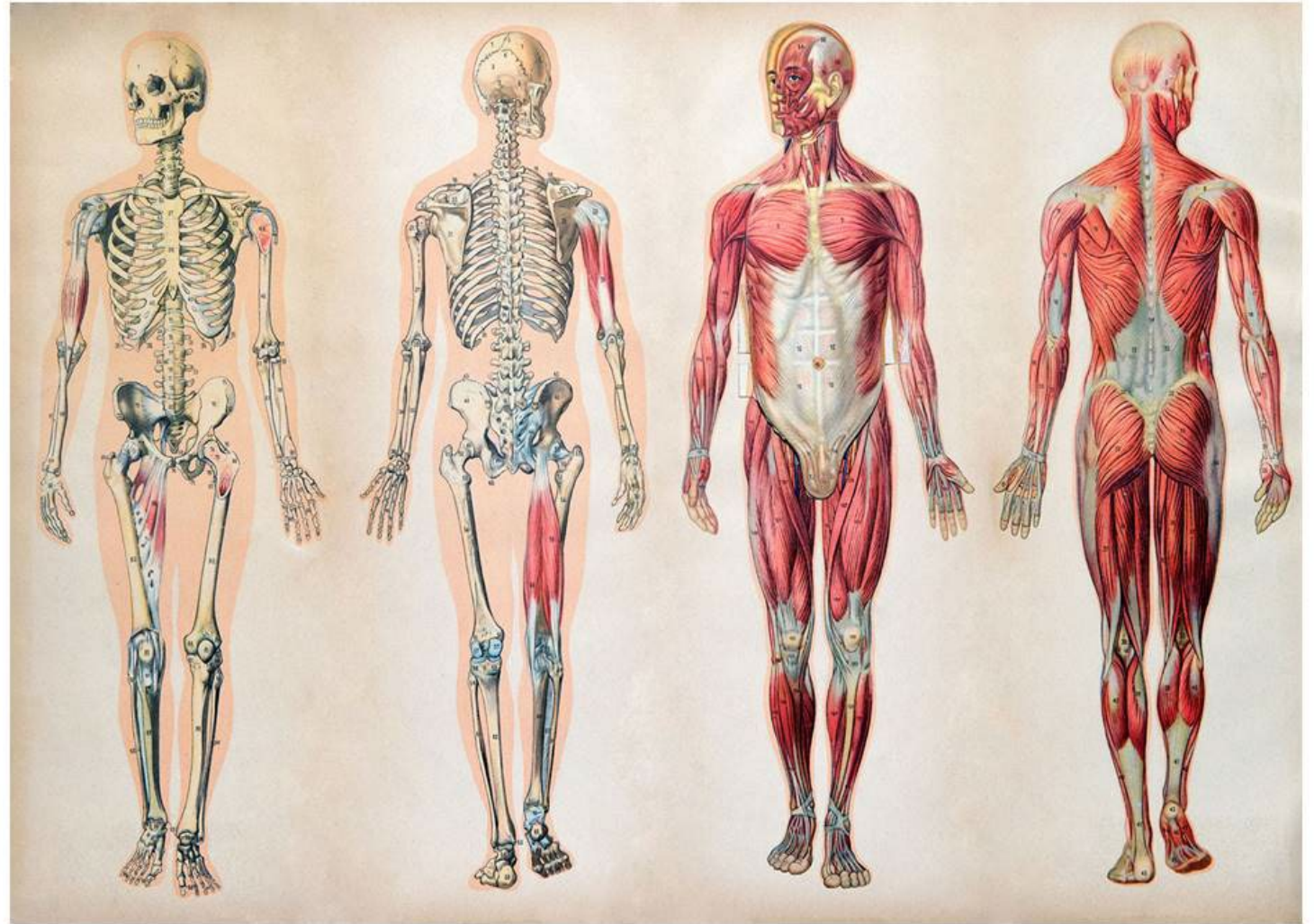
- Understand essential concepts in physiology
 - Homeostasis
 - Characteristic processes for living organisms
 - Structural and functional levels of organization
 - Organ-system levels in humans
- Recognize the basic anatomical terminology

Physiology

= science of living cells and organs, their interactions and regulation

Vs. anatomy = science of body structures and relationships among them

Related fields of science:
biology, chemistry, physics,
mathematics, pharmacology,
psychology, etc.



Subfields of physiology

- cell physiology
- System physiology
- Evolutionary physiology
- Exercise physiology
- Neurophysiology, endocrinology, cardiovascular physiology, immunology, respiratory physiology, nutritional physiology, reproductive physiology

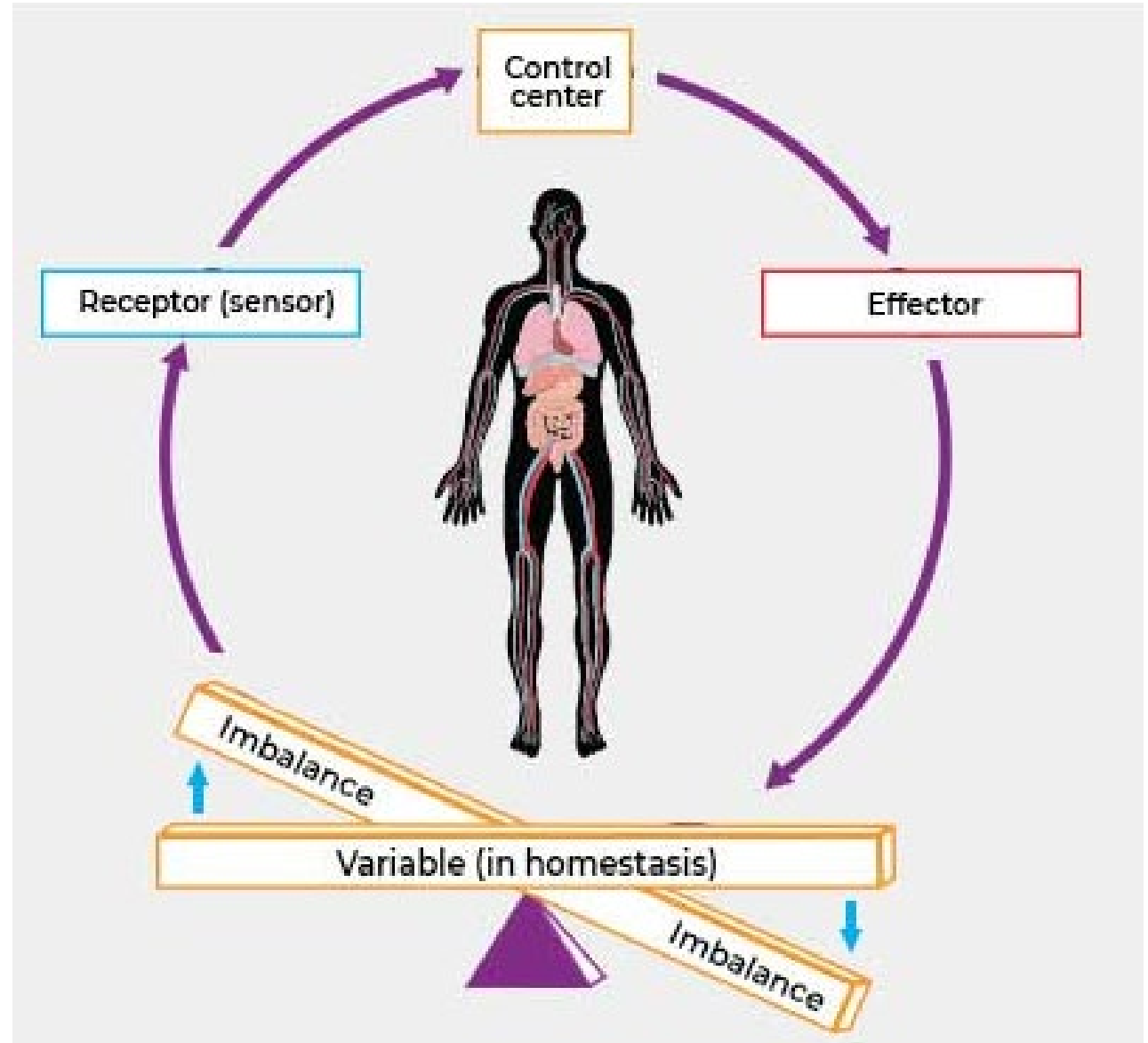


<https://www.thestrongside.ca/>

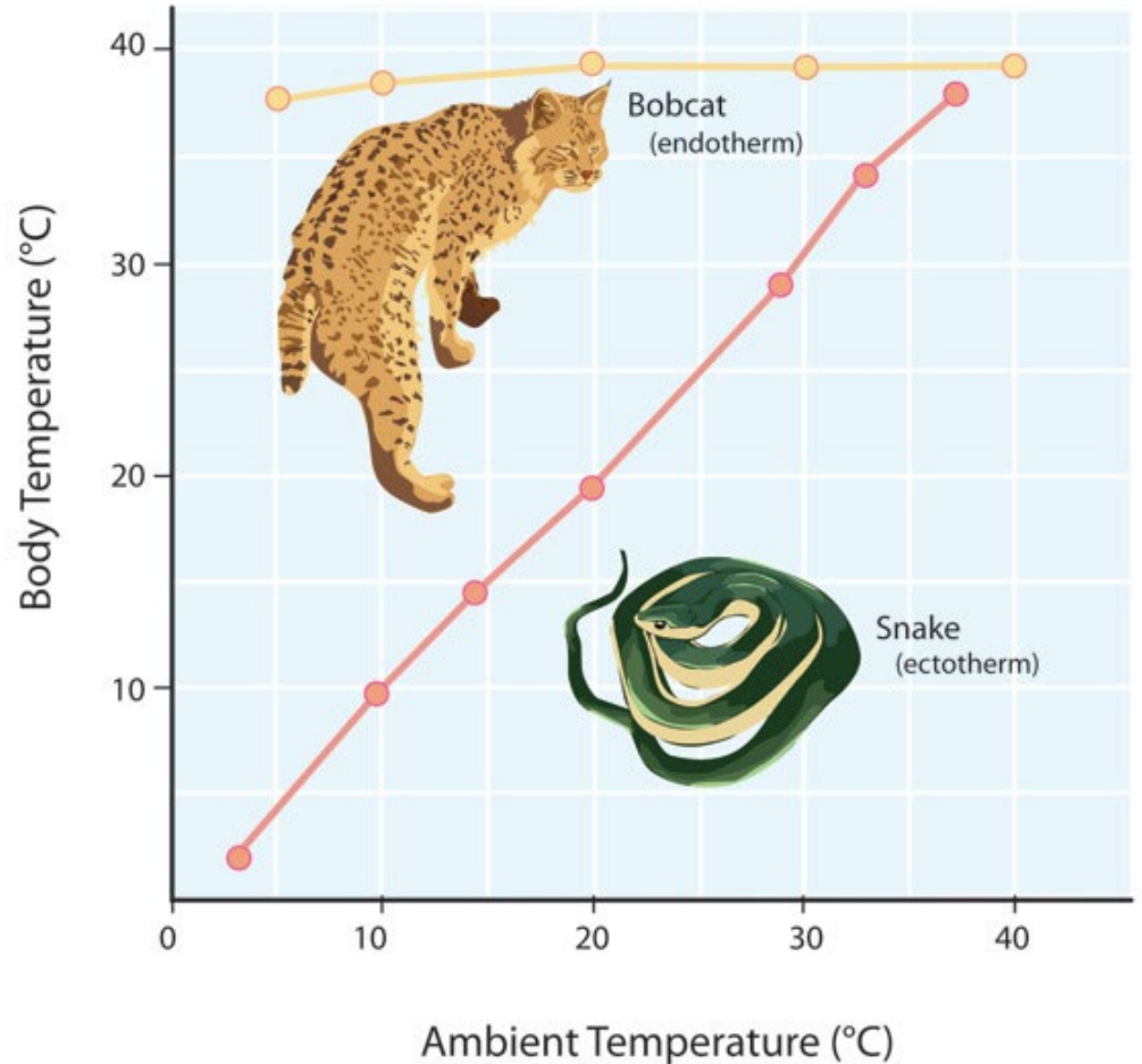
Core concepts in physiology

- Relationship between structure and function changes during the lifetime
- Physiology = “normal”, vs. pathophysiology
- Regulatory mechanisms are ~similar in different organ systems
- Homeostasis = ability of the system to keep its internal environment stable/constant

“We remain alive almost beyond our own control”



Example: Temperature control in animals with shivering, extra fur, fat, and blood circulation



<https://www.nature.com/scitable/knowledge/library/homeostatic-processes-for-thermoregulation-23592046/>

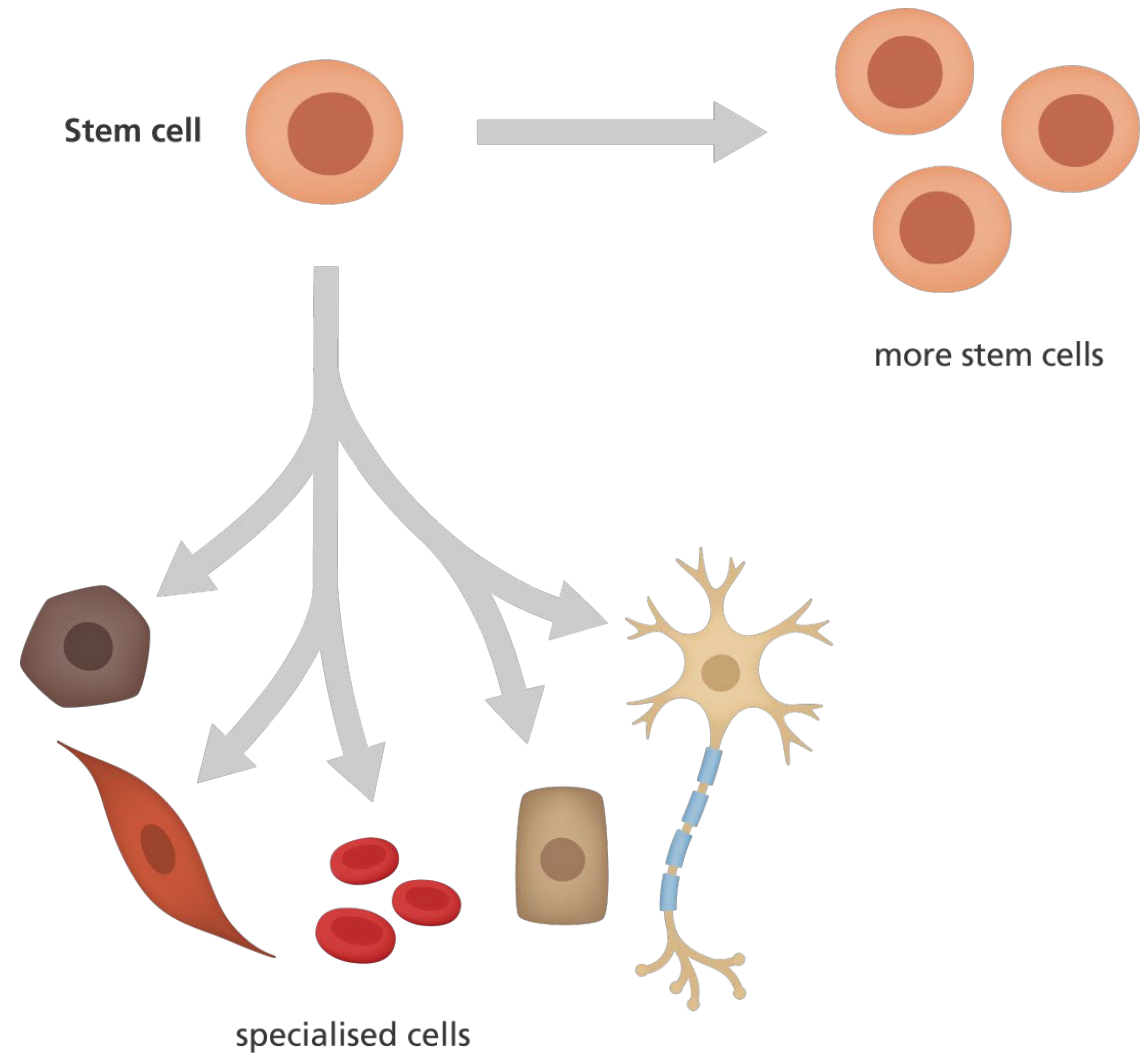
Characteristics of living organism

- Metabolism and breathing: catabolism vs. anabolism
- Responsiveness, ability to adopt to changes (e.g., temperature, sunlight)
- Movement (cell – organism level)
- Reproduction (also at the cell/tissue level)
- Growth



- Differentiation:

Stem cells → gametes (*i.e.*, reproductive cells) and somatic cells (nerve cells, blood cells, muscle cells, fat cells, epithelium cells, etc.)



Structural organization of the body

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Atoms, molecules, macromolecules

Organelles

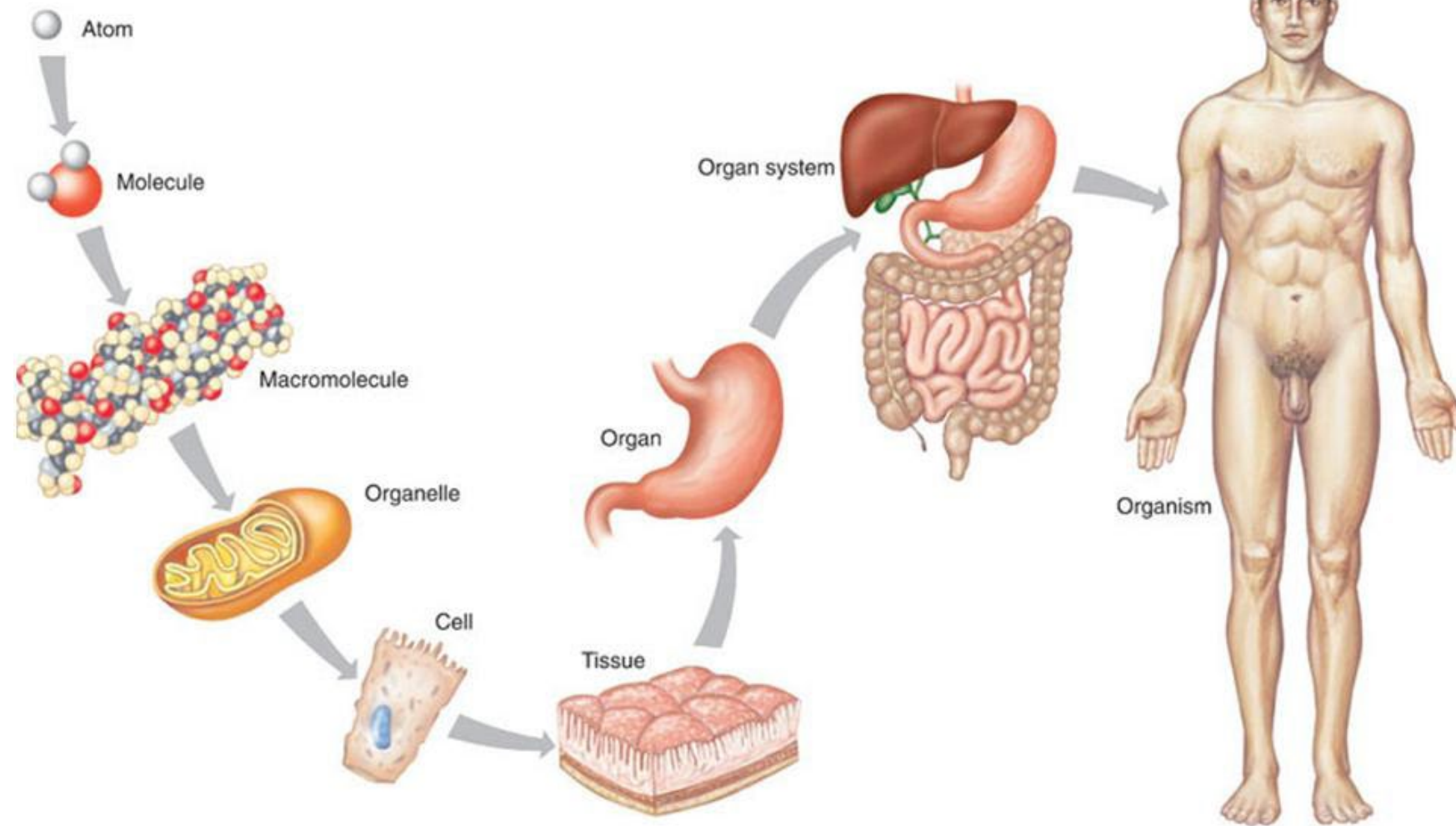
Cells

Tissue

Organ

Organ systems

Organism



Increasing complexity →

https://www.youtube.com/watch?v=dva-f_btvlk

Organism

Chemical level

Biological level

Atoms

Molecules

Cell

Tissue

Organ

Organ system

Organ systems

Skeletal and muscular systems

Cardiovascular system

Respiratory system

Digestive system

Nervous system

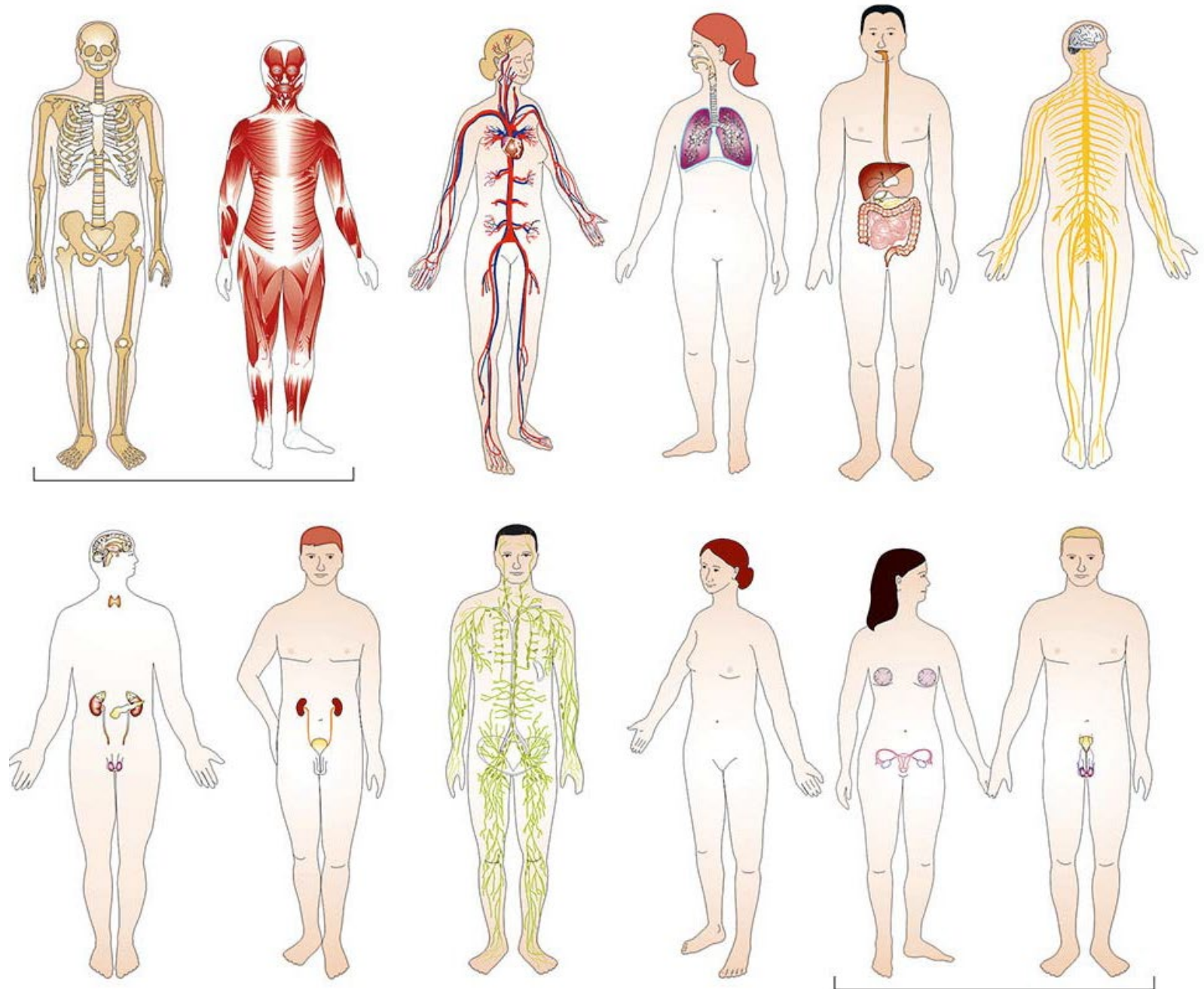
Endocrine system

Urinary system

Lymphatic system

Skin/Integumentary system

Reproductive systems



Functional levels of the body

✓ Protection, support and movement

- Skeletal, muscular
- Integumentary

✓ Coordination and control

- Nervous
- Endocrine

✓ Circulation and immunity

- Cardiovascular
- Lymphatic

✓ Energy supply and fluid balance

- Respiratory
- Digestive
- Urinary

✓ Production of offsprings

- Reproduction

Organ systems

Skeletal and muscular systems

Cardiovascular system

Respiratory system

Digestive system

Nervous system

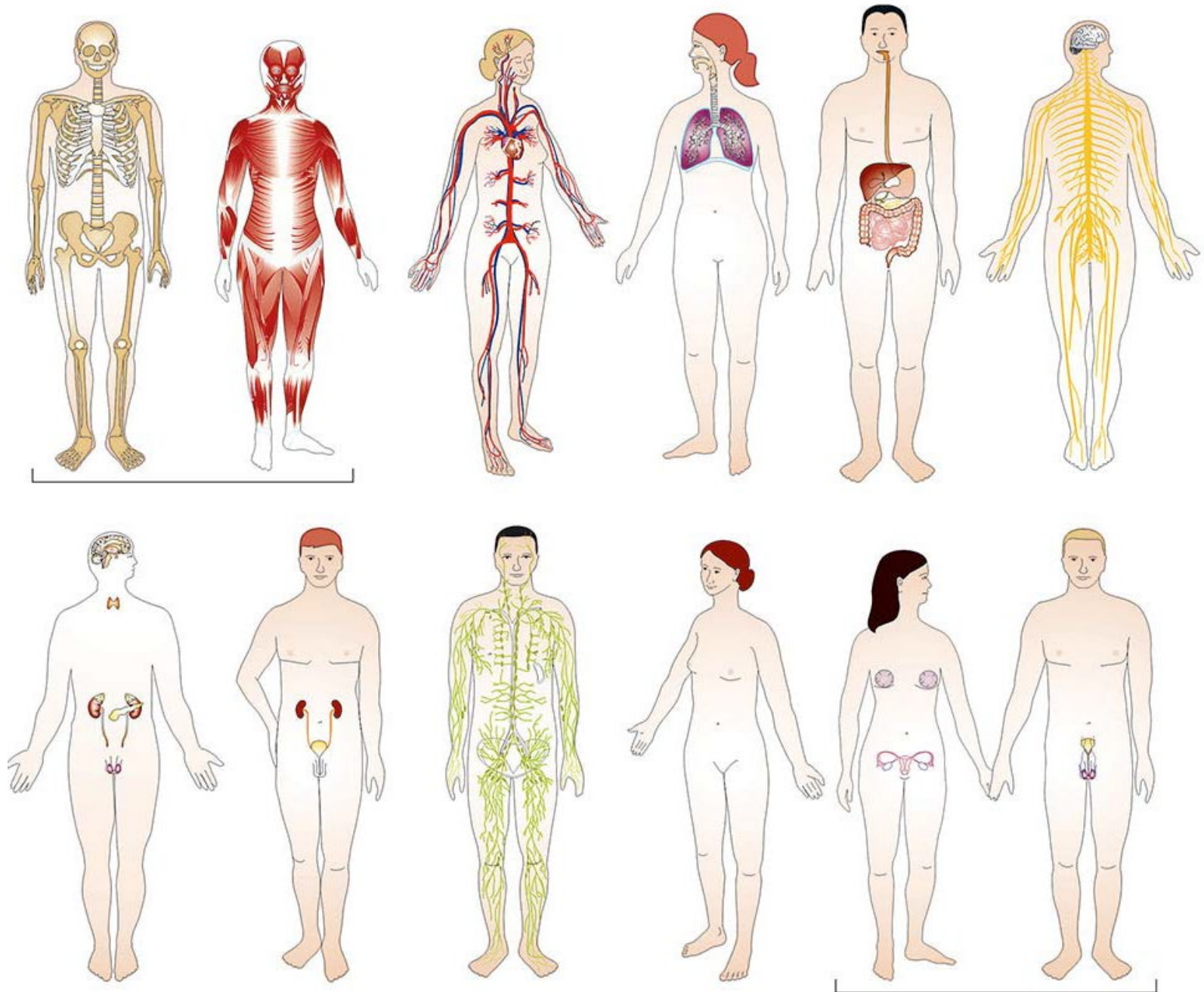
Endocrine system

Urinary system

Lymphatic system

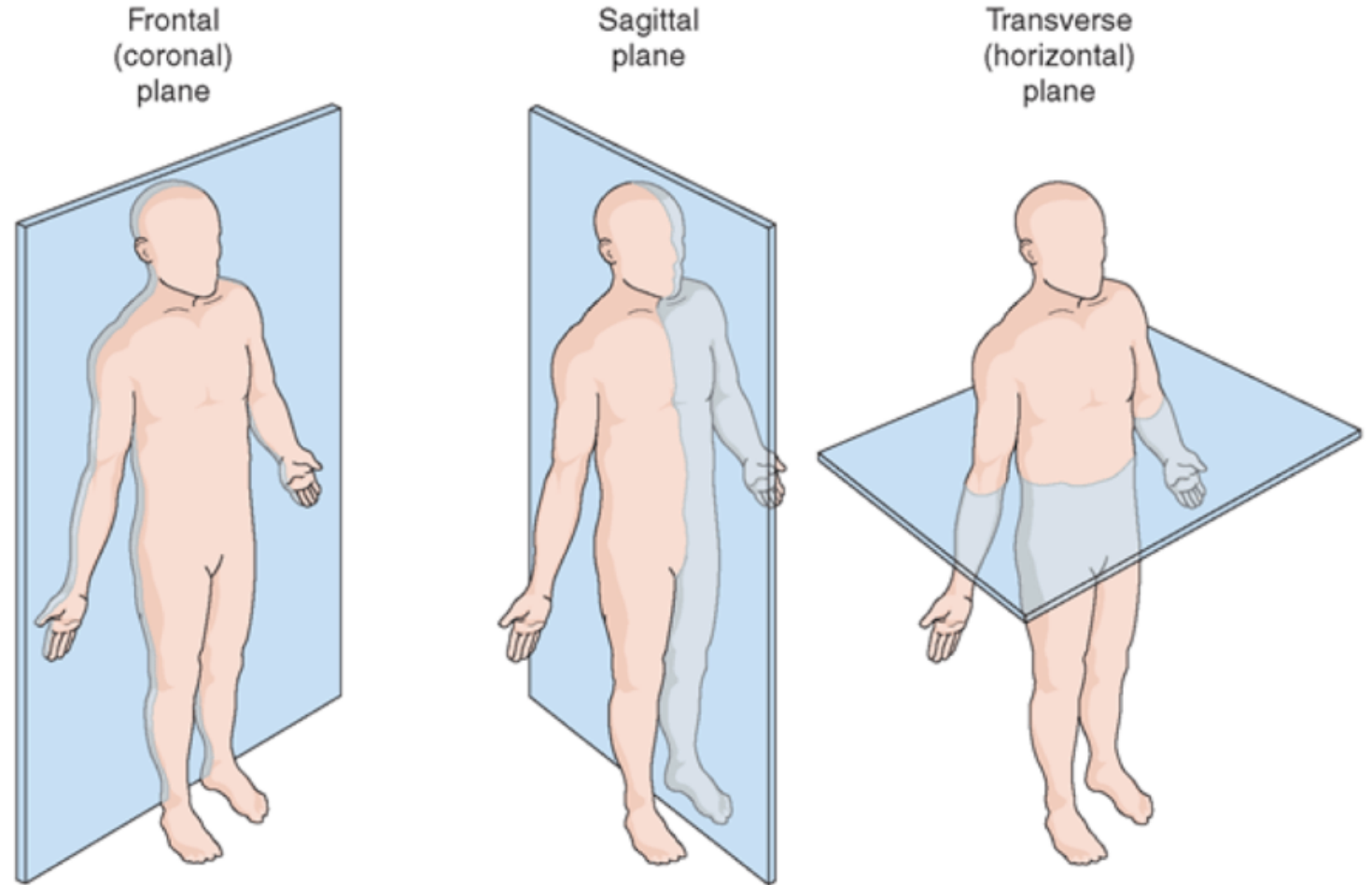
Skin/Integumentary system

Reproductive systems

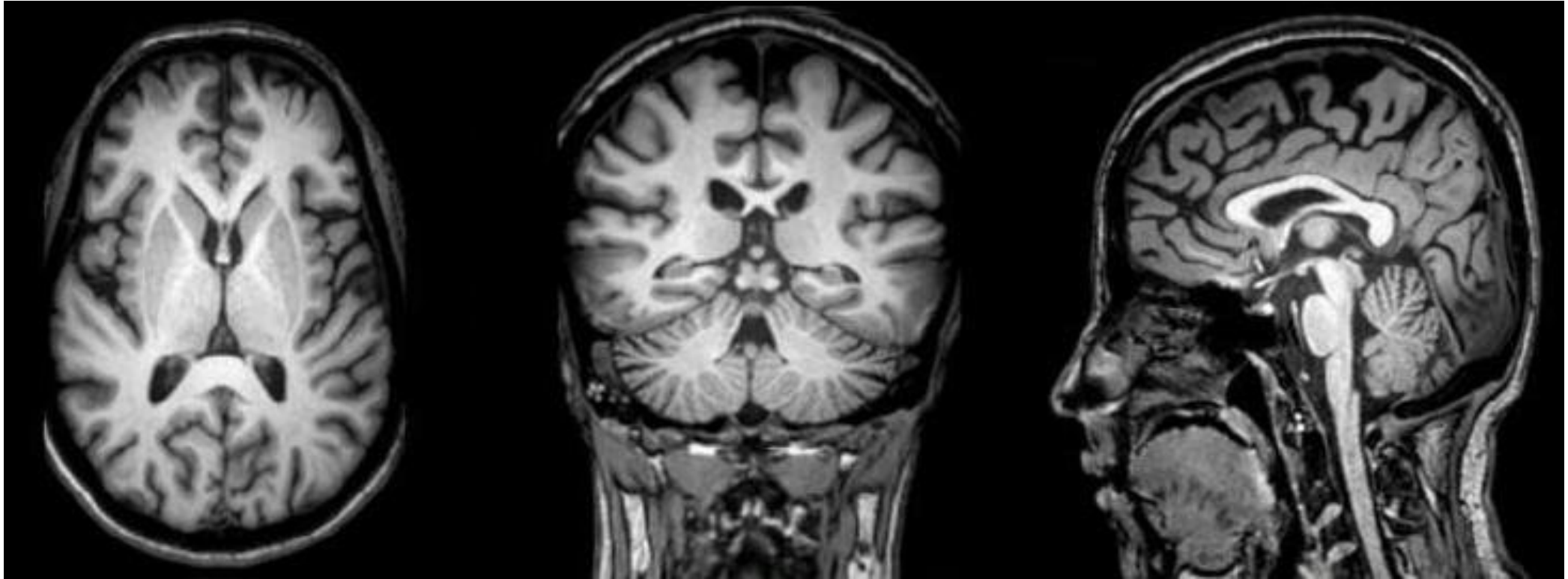


Basic anatomical terminology: Planes

- Imaginary planes that divide the body, used to increase the precision in describing body structures
- Frontal (coronal) plane
- Sagittal plane
- Transversal (horizontal, axial) plane



Example: Different planes in MR image



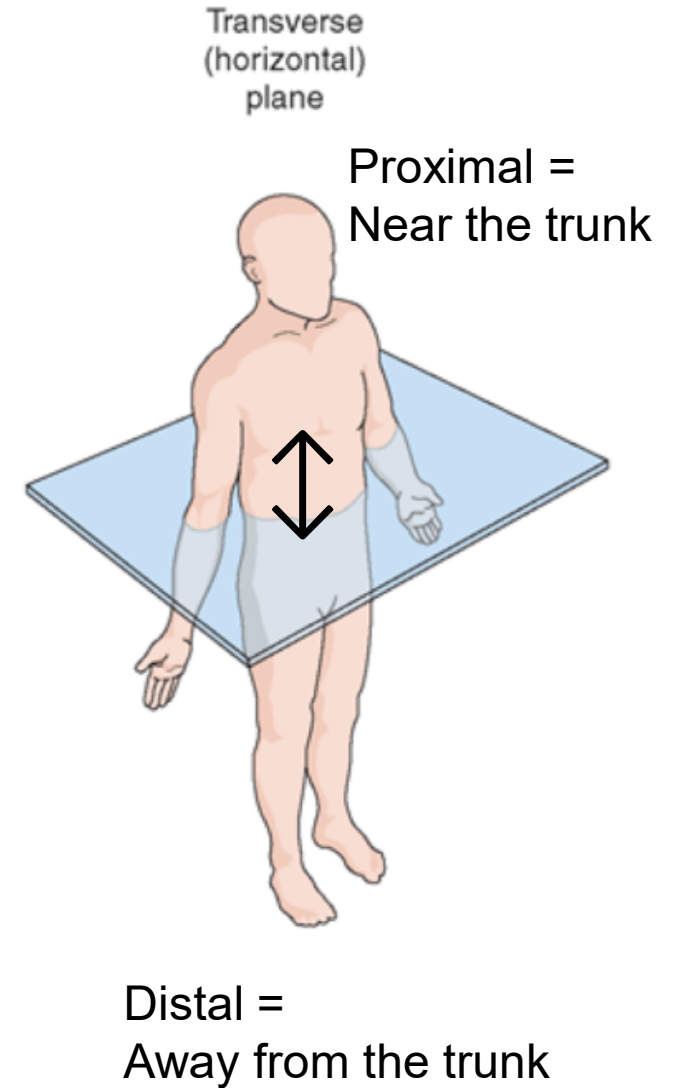
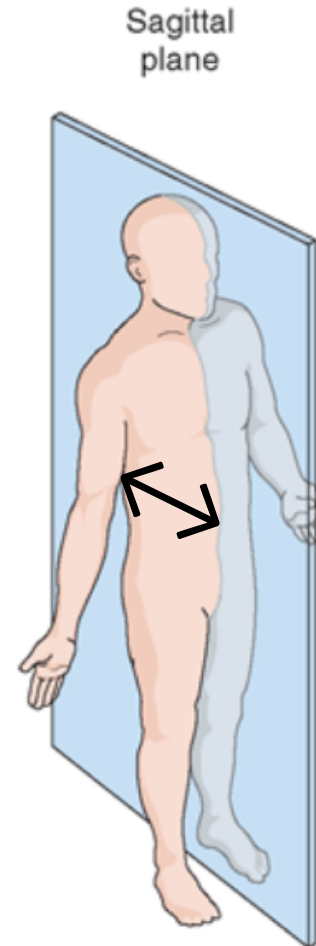
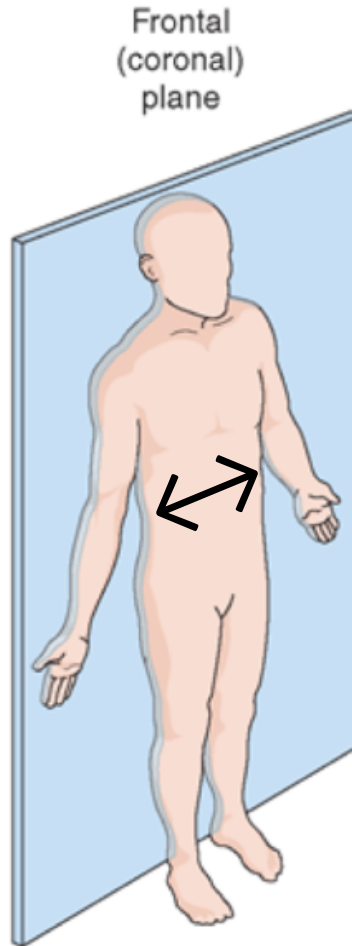
Transversal/axial/
horizontal

Frontal/coronal

Sagittal

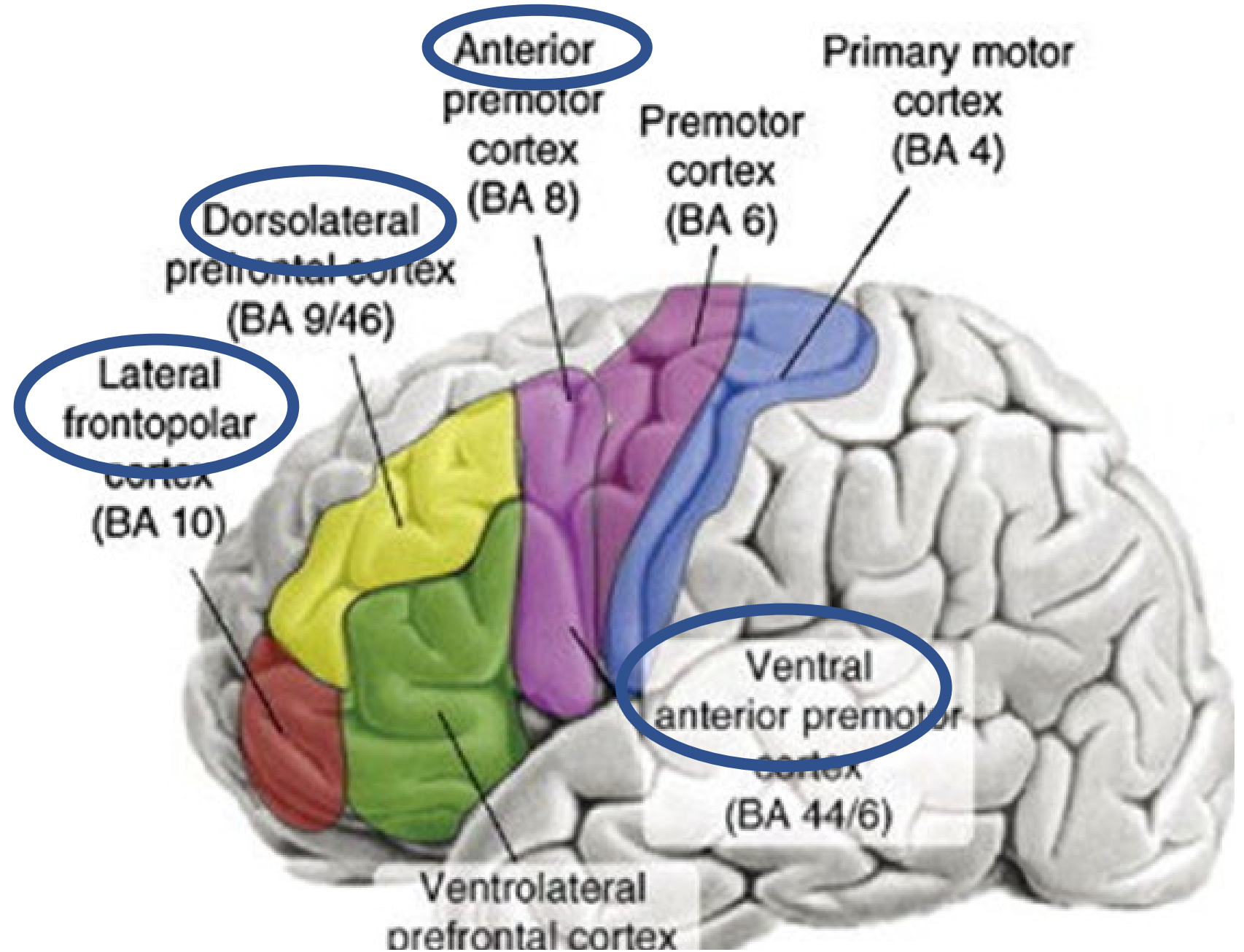
Basic anatomical terminology: Directions

- Medial = near the midline
- Lateral = away from the midline
- Anterior = at the front of the body
- Posterior = at the back of the body
- Ventral = abdominal
- Dorsal = back of the body
- Superior = toward the head
- Inferior = away from head
- Cranial = relating to the skull
- Caudal = near the tail



Distal =
Away from the trunk

Example:
Naming of
brain areas



Class exercise

