**Introduction to Anatomy**

**Dr. Gary Mumaugh – Bethel University**

**Overview of Anatomy**

* Anatomy – the study of the structure of body parts and their relationships to one another
  + Gross or macroscopic
  + Microscopic
* Physiology – the study of the function of the body’s structural machinery

**Gross Anatomy**

* Regional – all structures in one part of the body   
  (such as the abdomen or leg)
* Systemic – gross anatomy of the body studied by system
* Surface – study of internal structures as they relate to the overlying skin

**Microscopic Anatomy**

* Cytology – study of the cell
* Histology – study of tissues

## **Other Branches of Anatomy**

### Developmental anatomy

### Embryology

### Pathological anatomy (pathology)

### Radiographic anatomy

### Functional morphology

**Levels of Structural Organization**

* Chemical – atoms combined to form molecules
* Cellular – cells are made of molecules
* Tissue – consists of similar types of cells
* Organ – made up of different types of tissues
* Organ system – consists of different organs that work closely together
* Organism – made up of the organ systems

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**Characteristics of Life**

* Movement – locomotion, propulsion (peristalsis), and contractility
* Responsiveness – ability to sense changes in the environment and respond to them
* Growth – increase in size of a body part or of the organism
* Reproduction – cellular and organism levels
* Cellular – an original cell divides and produces two identical daughter cells
* Organism – sperm and egg unite to make a whole new person
* Respiration – O2 and CO2 exchange
* Digestion – breakdown of ingested foodstuffs
* Absorption – passage of substances through membrane
* Assimilation – changing absorbed substances into different chemical forms
* Excretion – removal of wastes from the body
* Maintaining boundaries – the internal environment remains distinct from the external
  + Cellular level – accomplished by plasma membranes
  + Organism level – accomplished by the skin

**Homeostasis**

* Homeostasis is the ability to maintain a relatively stable internal environment in an ever-changing outside world
* The internal environment of the body is in a dynamic state of equilibrium
* Chemical, thermal, and neural factors interact to maintain homeostasis

**Homeostatic Control Mechanisms**

* The variable produces a change in the body
* The three interdependent components of control mechanisms are:
  + Receptor – monitors the environments and responds to changes (stimuli)
  + Control center – determines the set point at which the variable is maintained
  + Effector – provides the means to respond to the stimulus
* Negative Feedback
  + In negative feedback systems, the output shuts off the original stimulus
  + If the receptors measure deviations from a set point, effectors are activated to return things to normal
  + Examples
    - Thermostatic controls of body
    - Regulation of blood glucose levels
* Positive Feedback
  + In positive feedback systems, the output enhances or exaggerates the original stimulus
  + Example: Regulation of blood clotting
  + Positive Feedback Loops
    - Normal way of producing rapid changes occurs with childbirth, blood clotting, protein digestion, fever, and generation of nerve signals

**Homeostatic Imbalance**

* Disturbance of homeostasis or the body’s normal equilibrium
* Overwhelming of negative feedback mechanisms allowing destructive positive feedback mechanisms to take over
  + Disease = Dis ease

**Organ Systems of the Body**

* Integumentary system
  + Forms the external body covering
  + Composed of the skin, sweat glands, oil glands, hair, and nails
  + Protects deep tissues from injury and synthesizes vitamin D
* Skeletal system
  + Composed of bone, cartilage, and ligaments
  + Protects and supports body organs
  + Provides the framework for muscles
  + Site of blood cell formation
  + Stores minerals

**Organ Systems of the Body – continued**

* Muscular system
  + Composed of muscles and tendons
  + Allows manipulation of the environment, locomotion, and facial expression
  + Maintains posture
  + Produces heat
* Nervous system
  + Composed of the brain, spinal column, and nerves
  + Is the fast-acting control system of the body
  + Responds to stimuli by activating muscles and glands
* Cardiovascular system
  + Composed of the heart and blood vessels
  + The heart pumps blood
  + The blood vessels transport blood throughout the body
* Lymphatic system
  + Composed of red bone marrow, thymus, spleen, lymph nodes, and lymphatic vessels
  + Picks up fluid leaked from blood vessels and returns it to blood
  + Disposes of debris in the lymphatic stream
  + Houses white blood cells involved with immunity
* Respiratory system
  + Composed of the nasal cavity, pharynx, trachea, bronchi, and lungs
  + Keeps blood supplied with oxygen and removes carbon dioxide
* Digestive system
  + Composed of the oral cavity, esophagus, stomach, small intestine, large intestine, rectum, anus, and liver
  + Breaks down food into absorbable units that enter the blood
  + Eliminates indigestible foodstuffs as feces
* Urinary system
  + Composed of kidneys, ureters, urinary bladder, and urethra
  + Eliminates nitrogenous wastes from the body
  + Regulates water, electrolyte, and pH balance of the blood
* Male reproductive system
  + Composed of prostate gland, penis, testes, scrotum, and ductus deferens
  + Main function is the production of offspring
  + Testes produce sperm and male sex hormones
  + Ducts and glands deliver sperm to the female reproductive tract
* Female reproductive system
  + Composed of mammary glands, ovaries, uterine tubes, uterus, and vagina
  + Main function is the production of offspring
  + Ovaries produce eggs and female sex hormones
  + Remaining structures serve as sites for fertilization and development of the fetus
  + Mammary glands produce milk to nourish the newborn

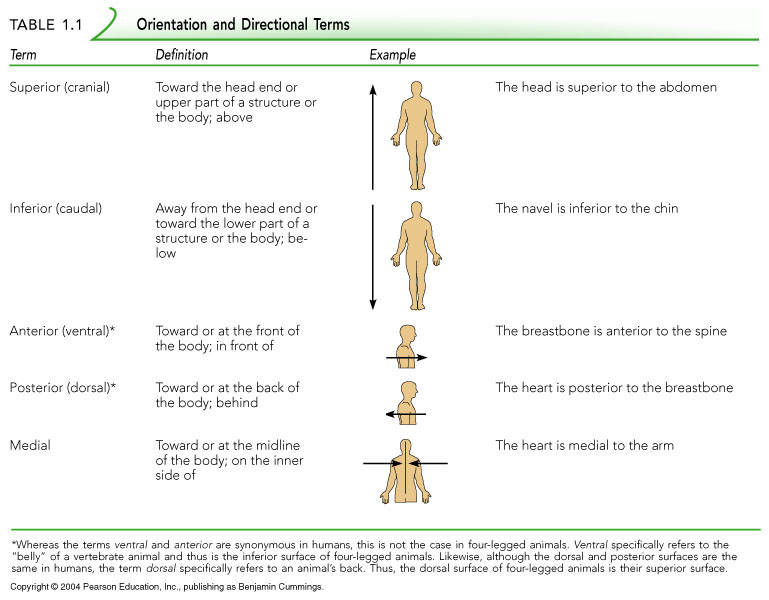
**What systems do which function?**

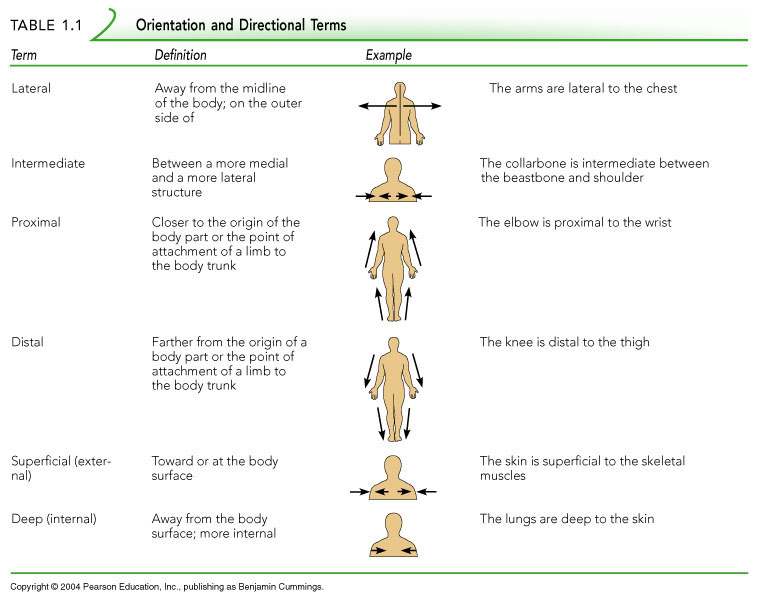
* Body covering
* Control - integration and coordination
* Transportation
* Absorption
* Excretion
* Reproduction

**Anatomical Position**

* Body erect, feet slightly apart, palms facing forward, thumbs point away from body



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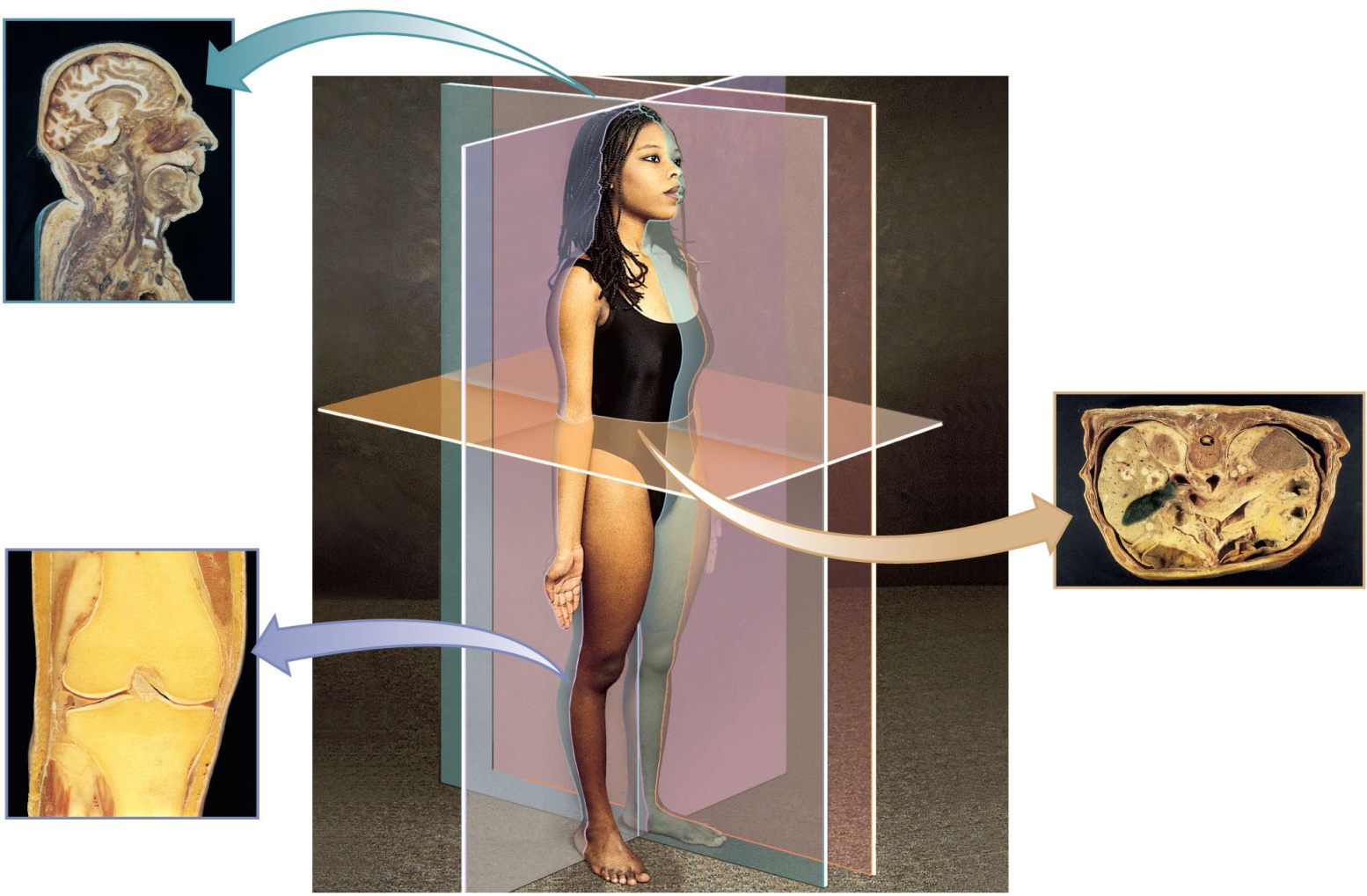
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**Regional Terms**

* Axial – head, neck, and trunk
* Appendicular – appendages or limbs
* Specific regional terminology

**Body Planes**

* Sagittal – divides the body into right and left parts
* Midsagittal or medial – sagittal plane that lies on the midline
* Frontal or coronal – divides the body into anterior and posterior parts
* Transverse or horizontal (cross section) – divides the body into superior and inferior parts
* Oblique section – cuts made diagonally



# **The Human Body Plan**

## Tube-within-a-tube

## Bilateral symmetry

## Dorsal hollow nerve cord

## Notochord and vertebrae

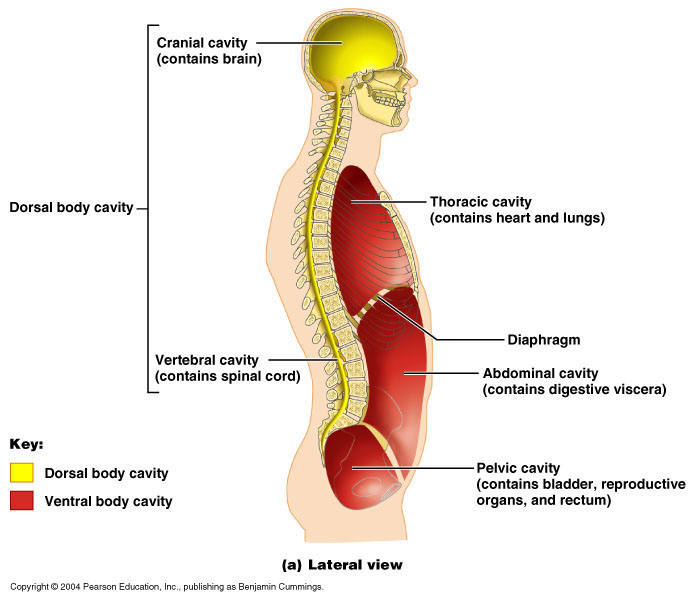
## Segmentation

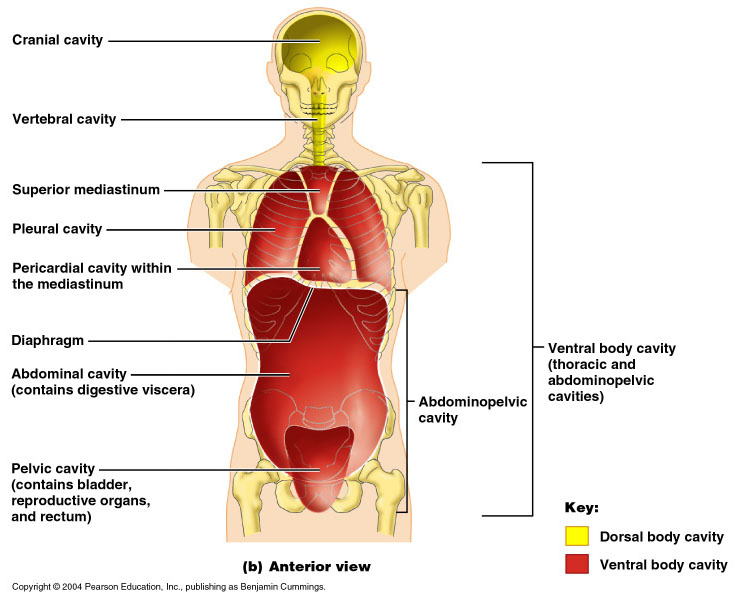
## Pharyngeal pouches

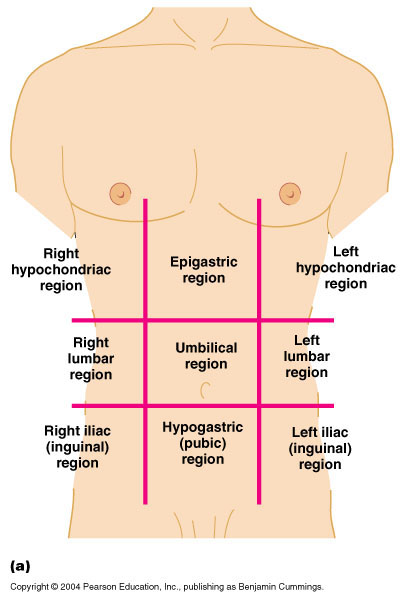
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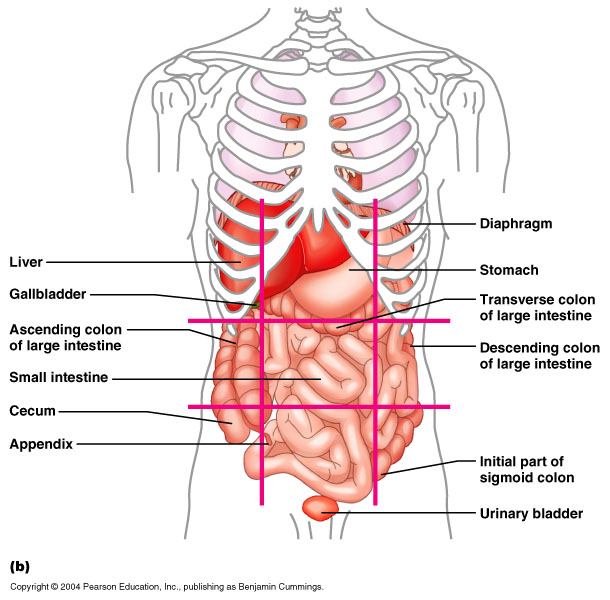
**Body Cavities**

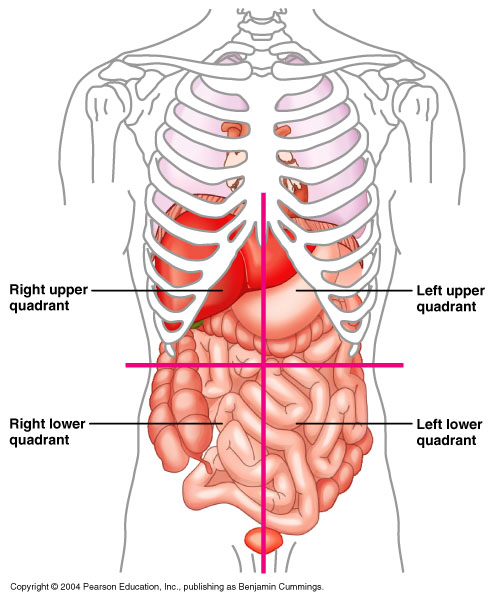
* Dorsal cavity protects the nervous system, and is divided into two subdivisions
  + Cranial cavity is within the skull and encases the brain
  + Vertebral cavity runs within the vertebral column and encases the spinal cord
* Ventral cavity houses the internal organs (viscera), and is divided into two subdivisions: thoracic and abdominopelvic
  + Thoracic cavity is subdivided into pleural cavities, the mediastinum, and the pericardial cavity
    - Pleural cavities – each houses a lung
    - Mediastinum – contains the pericardial cavity, and surrounds the remaining thoracic organs
    - Pericardial cavity – encloses the heart
  + The abdominopelvic cavity is separated from the superior thoracic cavity by the dome-shaped diaphragm - It is composed of two subdivisions
    - Abdominal cavity – contains the stomach, intestines, spleen, liver, and other organs
    - Pelvic cavity – lies within the pelvis and contains the bladder, reproductive organs, and rectum
* Other Body Cavities
  + Oral and digestive – mouth and cavities of the digestive organs
  + Nasal –located within and posterior to the nose
  + Orbital – house the eyes
  + Middle ear – contain bones (ossicles) that transmit sound vibrations
  + Synovial – joint cavities











# **Microscopic Anatomy**

## Microscopy—examining small structures through a microscope

### Light microscopy illuminates tissue with a beam of light (lower magnification)

### Electron microscopy uses beams of electrons (higher magnification)

## Scanning electron microscopy

### Heavy metal salt stain—deflects electrons in the beam to different extents

## Artifacts

### Minor distortions of preserved tissues

### Not exactly like living tissues and organs

# **Clinical Anatomy—An Introduction to Medical Imaging Techniques**

## X ray—electromagnetic waves of very short length

### Best for visualizing bones and abnormal dense structures

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# **Advanced X-Ray Techniques**

## **Computed (axial) tomography** (CT or CAT)

### Takes successive X rays around a person’s full circumference

### Computer translates recorded information into a detailed picture of the body section

# **Advanced X-Ray Techniques**

## Angiography

### Contrast medium highlights vessel structure

### Digital subtraction angiography (DSA)

#### Images taken before and after contrast medium injection

#### Computer subtracts “before” from “after” to identify blockage of arteries to heart wall and brain

## **Positron emission tomography** (PET)—forms images by detecting radioactive isotopes injected into the body

## **Sonography** (ultrasound imaging)—body is probed with pulses of high-frequency sound waves that echo off the body’s tissues

### Imaging technique used to determine the age of a developing fetus

## **Magnetic resonance imaging** (MRI)—produces high-quality images of soft tissues

### Distinguishes body tissues based on relative water content

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