Chapter 1: An Introduction to the Human Body

Chapter Outline and Objectives

ANATOMY AND PHYSIOLOGY DEFINED

1. Define anatomy and physiology.

BASIC ANATOMICAL TERMINOLOGY

2. Describe the anatomical position.
3. Define several directional terms used in association with the human body.
4. Define several anatomical planes and sections used in association with the human body.
5. Define body cavity and list the principal body cavities.
6. For each body cavity, list the organs contained within them.
7. Note the components of the serous membranes, their function, and how they are named in the body cavities.

HOMEOSTASIS

8. Define homeostasis.
9. Distinguish between intracellular and extracellular fluids and describe the different compartments of extracellular fluid.
10. Explain the effects of disruptions of body functioning on homeostasis.
11. List the two body systems that control homeostasis.
12. Define the major components of a feedback system and explain their role in homeostasis of a few controlled conditions.
13. Describe the difference in purpose and operation of negative versus positive feedback systems.

MEDICAL IMAGING

14. Describe the different types of medical imaging and what they are used to detect.

Chapter Lecture Notes

Anatomy - study of structure (Fig 1.1)

Gross (Macroscopic) anatomy – examination of large structures and features

Microscopic anatomy – examination of structures that cannot be seen without magnification

Many levels of anatomy

Chemical
Cellular
Tissue
Organ
Organ System
Organism

**Physiology** - study of function of body parts

Each structure is custom-modeled to carry out a particular function

structure of a part often determines the function

**Anatomical position** *(Fig 1.5)*

body upright facing observer

arms at side

palms facing forward *(supinated)*

**Directional Terms (anatomical directions)** *(Fig 1.6)*

**Superior (cranial)** - toward head or above another structure

**Inferior (caudal)** - away from head or below another structure

**Ventral** - belly side

**Dorsal** - back side

**Anterior** - that part which goes first (= ventral because belly goes first when we proceed *(anterior = ventral only in bipeds and not in quadripeds))*

**Posterior** - that part which follows (posterior = dorsal)

**Medial** - toward midline

**Lateral** - away from midline

**Ipsilateral** - on same side of body

**Contralateral** - on opposite sides of body (spleen (L) and appendix (R) are contralateral)

**Proximal** –

nearer to point of attachment of an extremity to trunk
ex. humerus is proximal to radius
nearer to point of reference (origin)
ex. proximal convoluted tubules in kidney nephrons

**Distal** –

further from attachment of an extremity to trunk
further from point of reference (origin)

**Superficial** – toward surface of body

**Deep** – away from the surface of the body; more internal

**Body Planes and Sections** *(Fig 1.7 & 1.8)*

**Plane** - imaginary flat surface

**Section** - flat surface resulting from a cut made through the structure

**Sagittal** - section resulting from a plane that divides the body into right and left portions

**Midsagittal** – a sagittal plane that lies along the midline

**Parasagittal** – a sagittal plane that is offset from the midline

**Frontal (Coronal)** - section resulting from a plane that divides body into front and back

(anterior and posterior)

**Transverse (cross) (xs)** - section resulting from a plane that divides body into superior and inferior portions along a horizontal plane *(actually any section that is a right angle to the length of a structure)* (a slice of bread is a cross section of a loaf of bread)

**Body Cavities** *(Fig 1.9)*

**Dorsal Cavity** - Back side – formed by cranium and vertebrae

**Cranial cavity** - contains brain

**Vertebral (spinal) canal** - contains spinal cord

**Ventral Cavity** – Belly side - organs inside are collectively called viscera, lined with serous membrane (peritoneum, pleura, pericardium)
Thoracic Cavity (Fig 1.10)

**Pleural cavity** - contains lungs (parietal and visceral pleura)

**Mediastinum** - mass of soft tissue between lungs from sternum to vertebral column (does not include lungs or bones)

- **anterior mediastinum** – thymus
- **middle mediastinum** - heart in pericardial cavity (parietal and visceral pericardium)
- **posterior mediastinum** - esophagus, trachea, aorta

Abdominopelvic - lined with parietal and visceral peritoneum (Fig 1.11 & 1.12)

(diaphragm divides the thoracic from abdominopelvic)

**Abdominal**

**Pelvic** - everything below an imaginary line from pubic symphysis to sacral promontory

**Homeostasis** - maintain stable (constant) internal environment

Homeostasis is continually disturbed by stressors that create imbalance in extra-cellular fluid (ECF)

**Extracellular Fluid (ECF)** - 1/3 of body fluid

- plasma
- interstitial - tissue, intercellular fluid
- lymph

**Intracellular Fluid (ICF)** – 2/3 of body fluid

Two systems control homeostasis in the body

- Nervous (fast)
- Endocrine (slower) - uses hormones

**Negative feedback mechanism is primary mechanism of control**

Mechanism of a feedback loop (Fig 1.2)
Stimulus (input = stressor)
Receptor
Control center (processes and decides)
Effector
Response

**Negative Feedback** - response (output) reverses stimulus (input=stressor) (Fig 1.3)

**Positive Feedback** - response enhances (intensifies) stimulus (Fig 1.4)

(only 2 good examples: labor contractions and blood clotting)

**Pathology** - disease conditions that result when homeostasis is disrupted

**Medical Imaging** (Table 1.3)

**Conventional X-ray (Radiography)**

ionizing radiation directed through the body

tissues absorb radiation according to densities

most economical

sometimes image not so clear/overlap of images

ex. mammography, angiogram, bone densitometry, intravenous urography and barium contrast X-ray

**MRI (formerly NMR) = Magnetic Resonance Imaging**

does not use X-rays

uses low energy radio waves with strong magnetic field

patient in a tunnel shaped magnet that is 3000x strength of earth's magnetic field

magnet aligns protons in atoms of cells

short bursts of radio waves introduced, causes protons to wobble-when frequency of wobbling motion and radio waves coincide, resonance has been achieved

not limited to transverse sections (xs); sagittal and frontal sections also obtained with MRI
cannot be used on patients with metal objects in body because of magnetic field
can detect tumors more readily than CAT scans, also used to detect damage to soft
tissues, clogged arteries, and brain changes

has not been clearly tested that MRI is free of risk; not used on pregnant women

**CT (CAT) Scan = computerized (axial) tomography**
used a series of X-rays arching body
computer reconstructs image of xs of body into multiple slices (tomograms)
used to detect strokes, aneurysms, cancers, infections that conventional X-ray cannot visualize
can only obtain xs (10-20 mm thick)

**Ultrasound**
uses high-frequency sound waves

**Coronary (Cardiac) Computed Tomography Angiography (CCTA)**
X-rays taken after injecting a contrast medium into an artery
Scanner detects the X-rays and computer transforms information into 3D images of blood vessels around the heart
used to detect blockages in arteries that supply the heart wall

**PET Scan – Positron emission tomography**
short lived radioisotopes that have been attached to a molecule (glucose) used by the body are injected into blood and patient put into Scanner
as the injected solution circulates and is metabolized in body tissues, the radioisotopes emit positrons which collide with electrons to make gamma rays that are detected by the scanner
computer constructs a multicolored image that shows the rate at which injected solution is being metabolized in different tissues

**Endoscopy**
a small, lighted camera is placed inside a body cavity so that a visual examination may be done

ex. colonoscopy, laparoscopy and arthroscopy

**Radionuclide Scanning**

Uses a gamma ray emitting, radioactive substance which is detected by a camera