INTRODUCTION AND SCOPE OF ANATOMY AND PHYSIOLOGY

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INTRODUCTION

- The human body is complex, like a highly technical and sophisticated machine.
- It operates as a single entity, but is made up of a number of operational parts that work interdependently.
- If any one part should be fail, the consequences are likely to extend to other parts, and may reduce the ability of the body to function normally.
- The human body is therefore complex in both its structure and function, and the aim of study is to explain the fundamental structures and processes involved.

- ***Anatomy*** is the study of the structure of the body and the physical relationships involved between body parts.
- Anatomy further divide into 2 groups:
  1. Gross Anatomy
  2. Histology
- ***Physiology*** is the study of how the parts of the body work, and the ways in which they cooperate together to maintain life and health of the individual.
- ***Pathology*** is the study of abnormalities and how they affect body functions, often causing illness.
- Building on the normal anatomy and physiology, relevant illnesses are considered.

Human Organization

- The human body is organized into structural and functional levels of increasing complexity.
- Each higher level incorporates the structures and functions of the previous level, as you will see.
- **Chemical Level**: The chemicals that make up the body may be divided into two major categories: inorganic and organic. **Inorganic chemicals** are usually simple molecules made of one or two elements other than carbon (with a few exceptions).
- **Organic chemicals** are often very complex and always contain the elements carbon and hydrogen.

- **Cellular Level:** The smallest living units of structure and function are **cells**. There are many different types of human cells, though they all have certain similarities.
- Each type of cell is made of chemicals and carries out specific chemical reactions.
- **Tissues Level:** A **tissue** is a group of cells with similar structure and function. There are four groups of tissues:
    1. **Epithelial Tissues:-** cover or line body surfaces
    2. **Connective Tissues:-** connect and support parts of the body
    3. **Muscular Tissues:-** brings about movement
    4. **Nervous Tissues:-** regulate body functions.

- **Organ Level:** An **organ** is a group of tissues precisely arranged so as to accomplish specific functions.
- For Example: The kidneys contain several kinds of epithelial, or surface tissues, for their work of absorption.
- **Organ System Level:** An **organ system** is a group of organs that all contribute to a particular function.
- For example: the urinary system, which consists of the kidneys, ureters, urinary bladder, and urethra. These organs all contribute to the formation and elimination of urine.

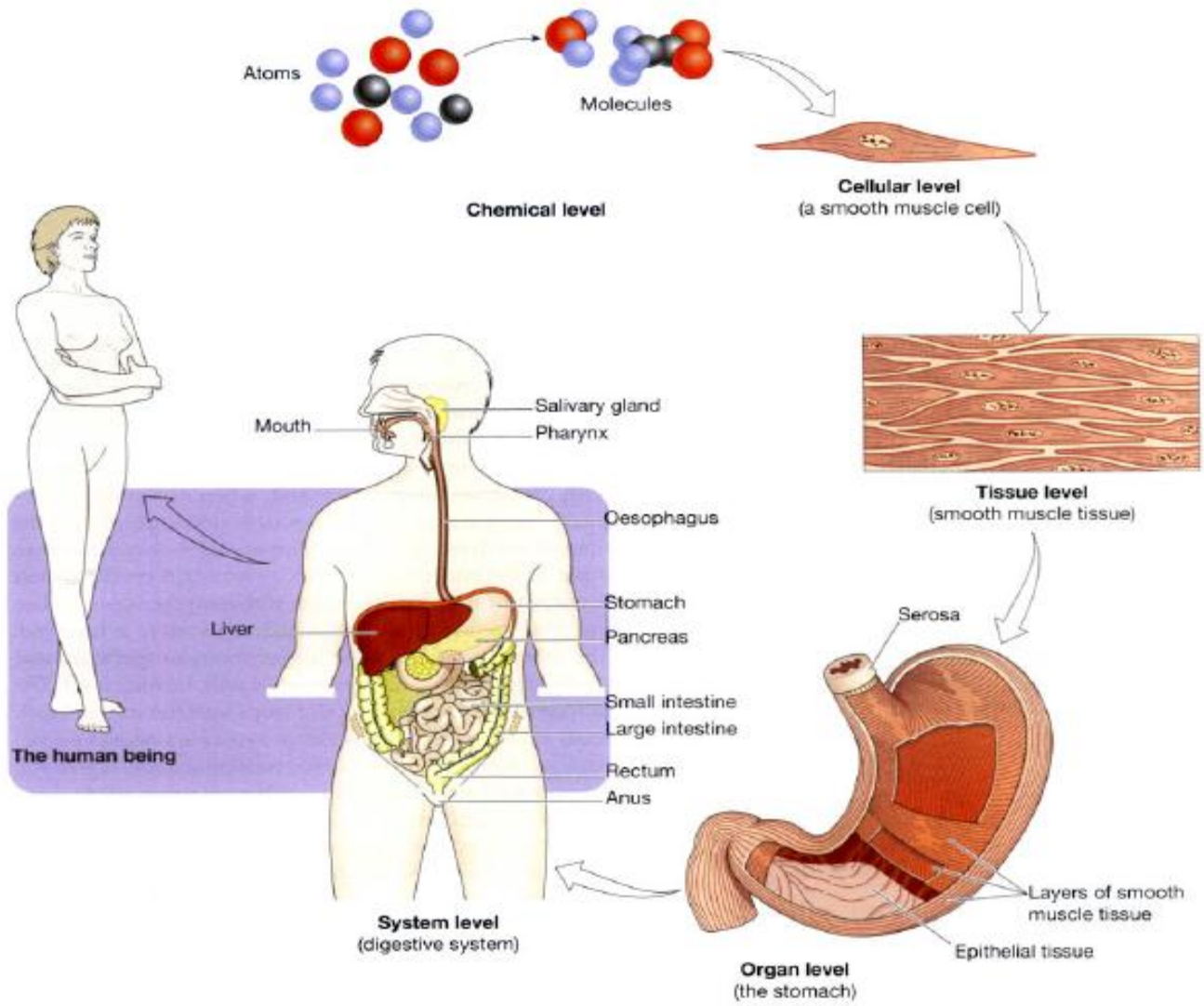


Figure 1.1 The levels of structural complexity.

DIFFERENT ORGAN SYSTEMS

System	Functions	Organs*
Integumentary	• Is a barrier to pathogens and chemicals • Prevents excessive water loss	skin, subcutaneous tissue
Skeletal	• Supports the body • Protects internal organs and red bone marrow • Provides a framework to be moved by muscles	bones, ligaments
Muscular	• Moves the skeleton • Produces heat	muscles, tendons
Nervous	• Interprets sensory information • Regulates body functions such as movement by means of electrochemical impulses	brain, nerves, eyes, ears
Endocrine	• Regulates body functions such as growth and reproduction by means of hormones • Regulates day-to-day metabolism by means of hormones	thyroid gland, pituitary gland, pancreas
Circulatory	• Transports oxygen and nutrients to tissues and removes waste products	heart, blood, arteries
Lymphatic	• Returns tissue fluid to the blood • Destroys pathogens that enter the body and provides immunity	spleen, lymph nodes
Respiratory	• Exchanges oxygen and carbon dioxide between the air and blood	lungs, trachea, larynx, diaphragm
Digestive	• Changes food to simple chemicals that can be absorbed and used by the body	stomach, colon, liver, pancreas
Urinary	• Removes waste products from the blood • Regulates volume and pH of blood and tissue fluid	kidneys, urinary bladder, urethra
Reproductive	• Produces eggs or sperm • *In women*, provides a site for the developing embryo-fetus	*Female*: ovaries, uterus *Male*: testes, prostate gland

*These are simply representative organs, not an all-inclusive list.

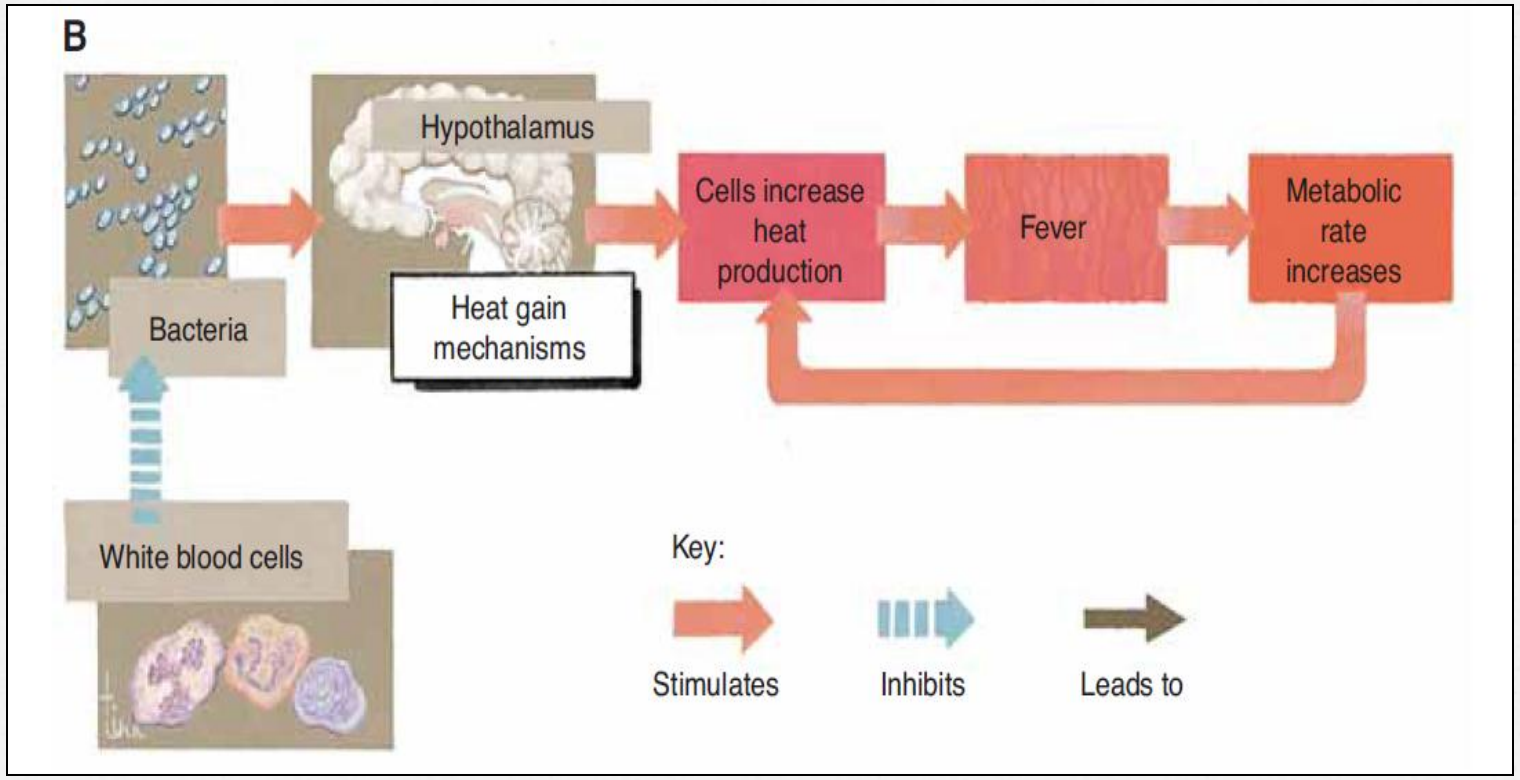
Homeostasis

- The composition of the internal environment is maintained within narrow limits, and this fairly constant state is called ***homeostasis***.
- This term means 'unchanging', but in practice it describes a dynamic, ever-changing situation kept within narrow limits. When this balance is threatened or lost, there is a serious risk to the well-being of the individual.
- **Examples of physiological variables:**
  - Temperature
  - Water and electrolyte concentrations
  - pH of body fluids
  - Blood glucose levels
  - Blood and tissue O_2 and CO_2 levels
  - Blood pressure

- Homeostasis is maintained by control systems which detect and respond to changes in the internal environment.
- A control system has three basic components: Detector, Control centre and Effector.
- The ***control centre*** determines the limits within which the variable factor should be maintained.
- It receives an input from the ***detector or sensor***, and integrates the incoming information.
- When the incoming signal indicates that an adjustment is needed the *control centre* responds and its output to the ***effector*** is changed.
- This is a dynamic process that maintains homeostasis.

POSITIVEFEEDBACK SYSTEMS

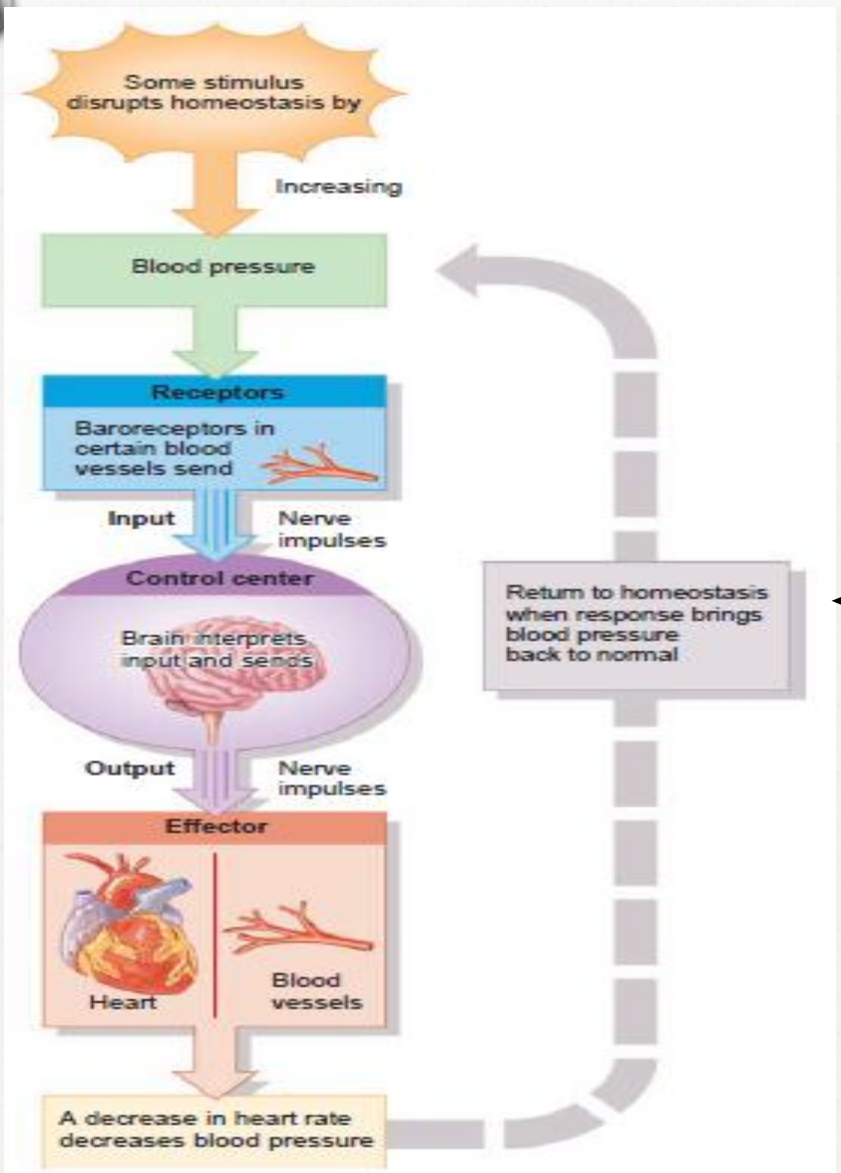
- A **positive feedback system** tends to *strengthen* or *reinforce* a change in one of the body's controlled conditions.
- A positive feedback system operates similarly to a negative feedback system, except for the way the response affects the controlled condition.
- The control center still provides commands to an effector, but this time the effector produces a physiological response that adds to or *reinforces* the initial change in the controlled condition. The action of a positive feedback system continues until it is interrupted by some mechanism.



POSITIVE FEED BACK MECHANISM

NEGATIVE FEEDBACK SYSTEM:

- A negative feedback system *reverses* a change in a controlled condition.
- Consider the regulation of blood pressure. Blood pressure (BP) is the force exerted by blood as it presses against the walls of blood vessels. When the heart beats faster or harder, BP increases. If some internal or external stimulus causes blood pressure (controlled condition) to rise, the following sequence of events occurs. *Baroreceptors* (the receptors), pressure-sensitive nerve cells located in the walls of certain blood vessels, detect the higher pressure. The baroreceptors send nerve impulses (input) to the brain (control center), which interprets the impulses and responds by sending nerve impulses (output) to the heart and blood vessels (the effectors). Heart rate decreases and blood vessels dilate (widen), which cause BP to decrease (response).
- This sequence of events quickly returns the controlled condition—blood pressure—to normal, and homeostasis is restored.
- Notice that the activity of the effector causes BP to drop, a result that negates the original stimulus (an increase in BP). This is why it is called a negative feedback system..



NEGATIVE FEEDBACK MECHANISM

Terminology

- Find definitions and memorize terms:
  - **Anterior**
  - **Posterior**
  - **Superior**
  - **Inferior**
  - **Medial**
  - **Lateral**
  - **Proximal**
  - **Distal**
  - **Superficial**
  - **Deep**
  - **Cephalic**
  - **Vertebral**
  - **Thoracic**
  - **Appendicular**
  - **Brachial**
  - **Lumbar**

Latin and Greek Prefixes and Suffixes

Acro- extremity. Acrophobia is a fear of heights.
Adeno- gland. Adenoid is a lymph gland found in the nasopharynx.
Alba- white. Albinsm is the white appearance of skin lacking melanin.
Algia- pain. Neuroalgia is a pain following the course of a nerve.
Angi- vessel. Angioplasty is the repair of a blood vessel.
Arthro- joint. Arthritis is the inflammation of skeletal joints.
Auto- self. Autolysis is the destruction of body cells by bodily enzymes.

Bio- living. Biology is the study of living organisms.
Blast- germ, bud. Osteoblast is the germ of a bone cell.
Blephar- eyelid. A blepharoplasty is eyelid surgery.
Brachi- arm. The brachialis muscle moves the arm.
Broncho- trachea, windpipe. Bronchitis is the inflammation of the respiratory system.
Bucc- cheek. The buccinator muscle is in the cheek.

Capit- head. De-capitate means "Off With the Head!"
Carcin- cancer. A carcinogen is a substance which triggers cancer formation.
Cardia- heart. Cardiologist is a heart specialist.
Cephal- head. Cephalon is another term for the brain. (see capit-)
Cerebro- brain. Cerebrospinal fluid (CSF) is fluid circulating within the brain and spinal cord.
Chole- bile, gall. Cholecestectomy is removal of the gallbladder.
Chondro- cartilage. A chondrocyte is a cartilage cell.
Chroma- color. Chromosomes are so named because they took color easily when dye is added to a cell.
Cili- eyelash. Supercilia are eyebrows -- the hairs above the eyelashes.
Corpus- body. Corpus albicans is the white body inside an ovary.
Corona Crown. Coronary arteries supply blood to the heart muscle run along the heart, encircling it like a crown.The coronary ligaments of the liver (which encircle the liver like a crown), the coronal suture and the corona of the glans penis, all structures which encircle something (like a crown).
Cost- rib. Costal cartilages attach ribs to the sternum.
Cut- skin. Cutaneous tissue is skin tissue.

Cysti- sac, bladder.
Cyto- cell. Cytology is the study of cells.

Dactyl- digits. Polydactylism is the presence of more fingers than is normal.
Derma- skin. Dermatologists are skin specialists. (see cut-)
Dura- tough, hard. Dura mater is the tough covering around the brain and spinal cord.

Entero- intestine. Enteritis is inflammation of the intestines.
Erythro- red. Erythrocytes are red blood cells.

Galacto- milk.Galactose-Milk Sugur; Galactosemia is the lack of ability to digest one of milk's sugars.
Gastro- stomach, belly. Gastric juices are produced in the stomach.
Glosso- tongue. Hypoglossal means "below the tongue".
Glyco- sugar. Glycosuria is sugar in the urine.

Hema- blood. Hemaglobin is a large molecule of the red blood cell.
Hepato- liver. The hepatic vein drains blood away from the liver.
Hyster- uterus. Hysterectomy is the removal of the uterus.

Ileo- ileum. Part of the small intestine.
Ilio- ilium. Part of the hip bone.

Lachry- tears. Lacrimal glands secrete tears.
Leuko- white. Leukocytes are white cells of the blood. (see alba-)
Lingua- tongue. Sublingual glands are beneath the tongue. (see glosso-)
Lipo- fat. Liposuction is the removal of fat by suction tube.
Lith- stone. Shock wave lithotripsy is a treatment for breaking up kidney stones.
Lumbo- lower back. Lumbar vertebrae are located in the lower back.

Macul- spot, blotch. The macula lutea is a spot on the retina of an eyeball.
Mamm- breast. Mammogram is a picture of a breast, usually a female breast.
Mast- breast. Aren't we showing our obsession with breasts?
Meningo- membrane. Meninges are the coverings of the brain and spinal cord.
Metro- uterus. Endometrium is the inner lining of the uterus. (see hystero-)
Morpho- shape. Endomorphs are people whose physical shape extends to the limits of human dimension.
Myelo- spinal cord. Poliomyelitis is inflammation of the grey matter of the spinal cord.

Myo- muscle. Myo-cardiac infarction is a problem with the heart muscle.

Necro- death. Necrosis is death of cell tissue.
Nephro- kidney. Nephrons are the functional units of a kidney.
Neuro- nerve. Neurons are individual nerve cells.

Oculo- eye. An oculist supplies eyeglasses.
Odont- tooth. Othodontics refers to repair of teeth.
Onco- tumour. Oncology is not doctors wearing pagers; it is the study of cancerous tumours.
Ophthalm- eye. Ophthalmology is the study of eye and its diseases.
Oro- mouth. The oral cavity is the other name for the mouth.
Orchido- testicle. Orchidectomy is removal of a testicle.
Osse-, Osteo- bone. Osteoporosis is porosity of bone.
Oto- ear. Otosclerosis is the formation of bone in the ear.Otomycosis-fungal infection in ear

Patho- disease. Pathogens are agents which cause disease.
Peps- digestion. Pepsin is an enzyme found in the digestive system.
Phago- eat. Phagocytes are cells (cyto-) which eat foreign material.
Philo- love, to have an affinity for. Hydrophilic molecules are attracted to water (hydro-)
Phleb- vein. Phlebitis is inflammation of the veins.
Phren- diaphragm. Phrenic refers to a diaphragm.
Pneumo- lung. Pneumonia is a disease of the lungs.
Pulmo- lung. Are lungs related to breasts?
Pyo- pus. Pyruria is pus in the urine.

Ren- kidney. Renal artery supplies blood to the kidney.
Rhin- nose. Rhinoplasty is a nose job

Scler- hard. Atherosclerosis is hardening of the arteries. (see dura-)
Stasis- stand still. Homeostasis is the process of maintaining constant conditions within the body.

Thromb- clot, lump. Thrombosis refers to a clot in the heart or blood vessel.
Trich- hair. Trichosis is a disease of the hair.

Vas- vessel, duct. Vas deferens is the vessel which carries sperm from the epididymus.
Viscer- organ. Visceral refers to organs.

Zoo- animal. Zoology refers to the study of animals.

THANKING YOU

ANY QUESTIONS ?