Human Anatomy and Physiology

☆ **Anatomy** :- It is the Science of Body Structures and relationship among them.

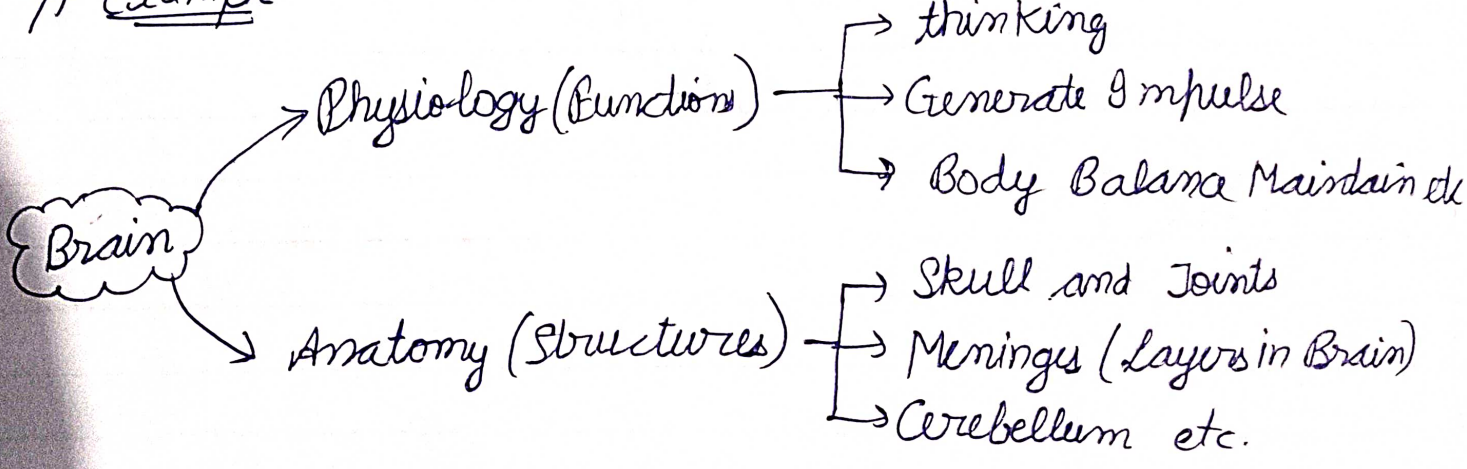
⇒ Anatomy was first studied by cutting the part of body structures to study their relationship

⇒ Anatomy deals with Structures of Body.

☆ **Physiology** :- It is the Sciena of Body functions

⇒ deals with how Body Parts functioning singly or together.

Example



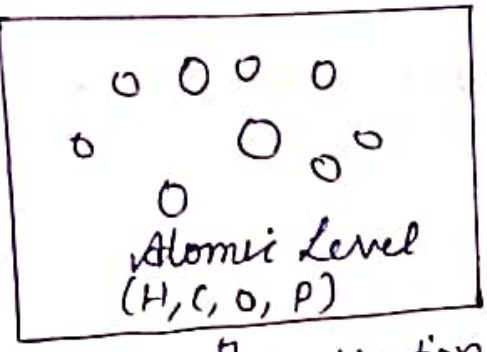
Levels of Structural Organization and Body Systems

There are Some level that help in understanding the Anatomy and Physiology of the Body.

⇒ By understanding of the levels can help us to understand the structure and functioning of Single and Smaller part of Body and also know about Whole System and Body

There are main 6 Levels of Structural Organization and Body Systems :-

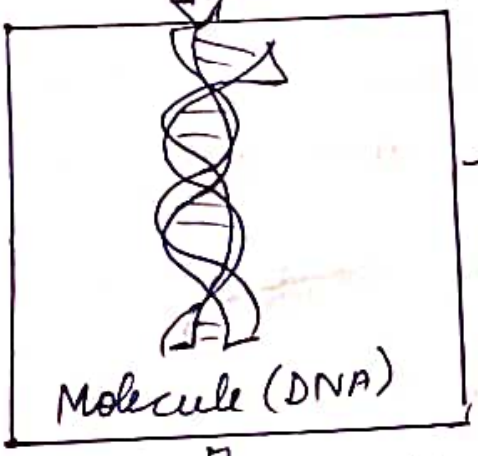
1. Cellular Level ← ☆ Chemical Level (Atom + Molecule)
2. Tissue Level
3. Organ Level
4. System Level
5. Organismal Level



Atomic Level
(H, C, O, P)

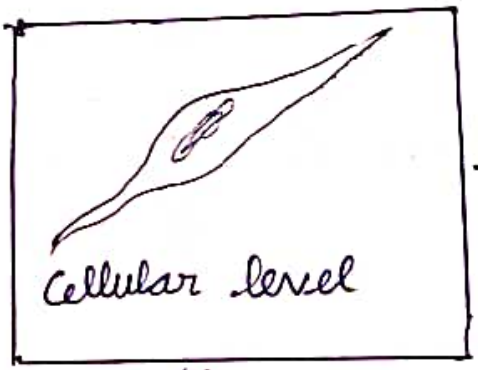
Level 1

Combination



Molecule (DNA)

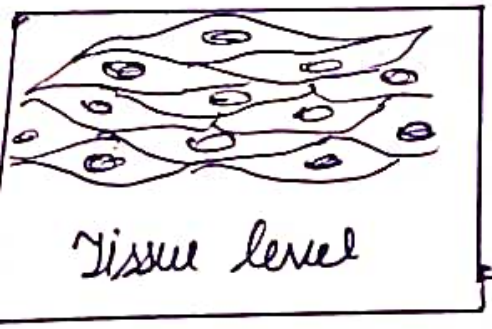
Combination



Cellular level

Level 2

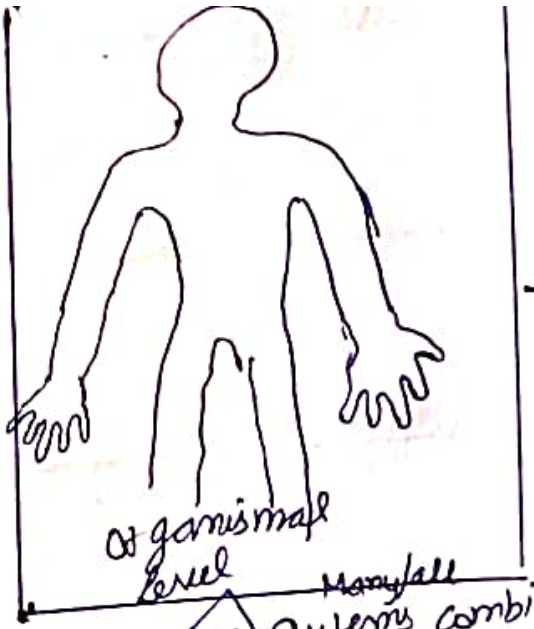
Combine



Tissue level

Combine

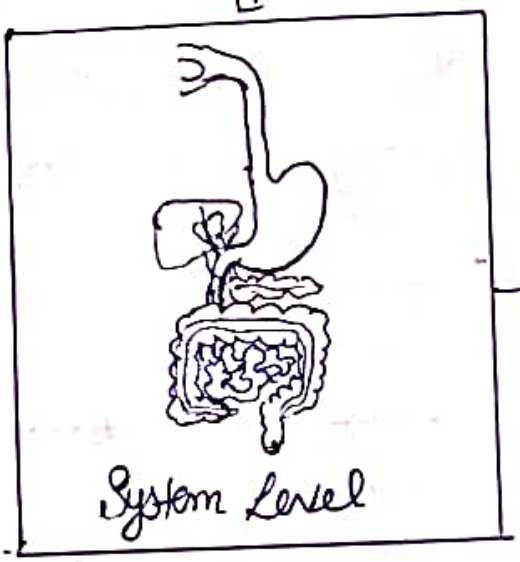
Level 3



Organismal Level

Level 6

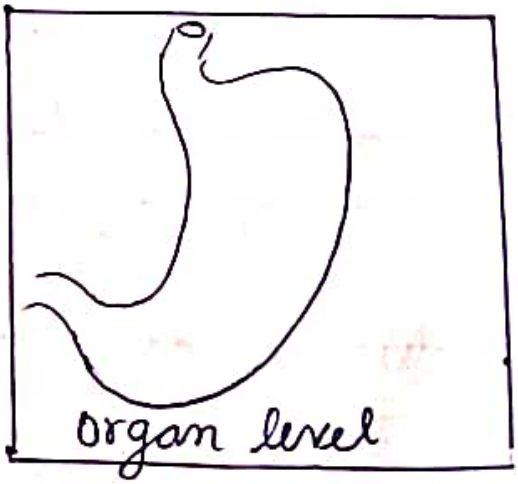
Many Systems combine



System Level

Level 5

Many Organs combine



Organ level

Level 4

For Better Understanding

① Chemical Level :- The Basic Level of the Body organisation in which atoms and Molecules Participates and Perform Chemical reactions or Pathways.

⇒ Atoms can combine to form molecules and then participates in various reactions.

Example - Atoms like hydrogen (H), oxygen (O), Phosphorus (P), Nitrogen (N), Sulfur (S) and carbon (C). Join together and form molecules of DNA and glucose.

② Cellular Level :- Molecules combines and form Cells.

⇒ Cells are the Basic Structural and functional unit of life.

⇒ There are different kinds of cells in the Body that performs different functions.

exam - Muscle cell, Nerve cells, Epithelial cells etc.

③ Tissue Level :- The cells combines and form a tissue.

⇒ Also, Tissue of different types having different type of shapes and functions.

⇒ Example - * Epethelial tissue - Cover Body Surfaces

* Connective tissue - Provide connection and support to Body organs.

* Muscular Tissue - Make Movements of Body parts and generate heat.

④ Organ Level :- Different types of Tissues Joined together and form an Organ.

⇒ Organ may also consist different Layers or Coverings that are of different tissues.

⇒ Specialised or Particular organ perform a specific function in the Body.

Exam - Skin, Bones, Heart - etc

⑤ System Level :- Different organs can combine and form a particular System.

⇒ Each System of Body can interrelates with another System But a particular System having their specific working ability and Structure.

Exam - * Cardiovascular / Pumping System (heart)

↓

Contain combination of Valves, Arteries, Veins etc.

* GIT (Gastro Intestinal Tract) / Alimentary Canal

↓

Contain combination of Food pipe, Stomach, (Small + Large) Intestines, anus etc.

⑥ Organismal Level :- Whole / All Systems of Body combines can Form a whole Body of an organism.

⇒ Body consist of Nervous System, cardiovascular System, Digestive System, Respiratory System, endocrine System and many other Systems.

Basic life Processes

There are some Basic life Processes that distinguish Living things from non-living things.

BASIC LIFE PROCESSES

- Metabolism
  - Catabolism
  - Anabolism
- Responsiveness
- Movement
- Growth
- Differentiation
- Reproduction

1. **Metabolism** :- It is the sum of all Chemical Processes that occur in Body.

Phases of Metabolism → Catabolism
Phases of Metabolism → Anabolism

⇒ Catabolism :- The processes in the Body that Breakdown the complex/Bigger Substance into Smaller/Simpler ones.

example - ☆ Protein —Catabolism→ Amino Acids etc.

☆ Fats —Catabolism→ Fatty acids etc.

⇒ Anabolism :- The process in Body that form a complex (Bigger) Substance or molecule by Joining of Smaller Substances

Example: Amino acids —Anabolise→ Protein

↓

used in making Body parts like bones and muscles.

(2) Responsiveness :- It is the ability of the Body that can detect the changes in body and respond to change.

Example:- Body detect the Environment change or enter any harmful microbe in body and increase the temperature of body in respond to the Body condition

(3.) Movement :- It include the motion of Body parts like organs, Single cells, and also a Smallest Structure present in a cell.

Example :- When any Body parts damaged and White Blood cell comes from Bloodstream and repair the Body parts and also replace the dead cells.

(4.) Growth :- The ability of Body result in increase in number of cells and also Size of cells.

→ Growth include in the increase in height of Body, Bone length etc

(5.) Differentiation :- The process of development of a Normal or unspecialized cell or part to a Specialized state

* Example :- * Red Blood Cell and white Blood Cell form from the Bone Marrow

* Development of Embryo from a fertilized Egg or Ovum

(6.) Reproduction :- It is the formation and development of a new cell from mother cell.

⇒ Reproduction occur to replace, growth or repair a cell or tissue

⇒ Reproduction also occur in the development of a new Individual. from Zygote

HOMEOSTASIS

Homeostasis is a condition that is responsible for balance the Internal Environment of the Body.

→ homeostasis also respond the change occur in the Body.

→ Each Cellular level to System level contribute in some way to keep the internal Environment of the Body within normal limits

→ homeostasis also play an important role in maintaining volume and composition of the Body fluids, dilute, watery Solutions containing dissolved chemicals that found inside the cells as well as surrounding them.

→ Proper Body functioning depends upon the regulation of composition of the fluids.

CONTROL OF HOMEOSTASIS

In some conditions, some External disruptions or Problems generate from External Environment such as access heat in hot Summers also lack of enough oxygen.

→ In such conditions, homeostasis imbalances occurs.

→ Small change or mild homeostasis can lead to repairing of Body's Internal Enviroment by the cells and tissue System

→ Large change occur more imbalance in the homeostasis as result in generation

of Severe Infection or Poisonous effect.

→ Body having many Regulation Systems that Bring the Internal Environment into a normalised condition.

→ Nervous System (Brain + Spinal Cord) and Endocrine System (hormonal) working together that maintains homeostasis in the Body.

↳ Nervous System send electric signals to the Body organs that can disturbs homeostasis

↳ Endocrine System secrete/release many required hormones that help in feedback of the homeostasis.

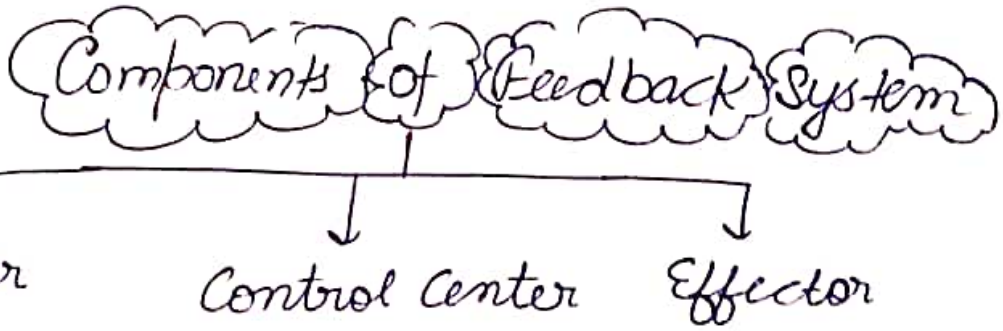
→ Feedback System can work on disturbance Site and help in controlling the Situation as per Requirements of the Body.

Feedback Systems

The body can regulate its internal environment through many feedback systems.

☆ Feedback System is a cycle of events in which Status of Body conditions is monitored, changed, re-evaluated, evaluated and so on.

☆ Feedback System works on different situations like body temperature, blood Pressure, Blood glucose level.



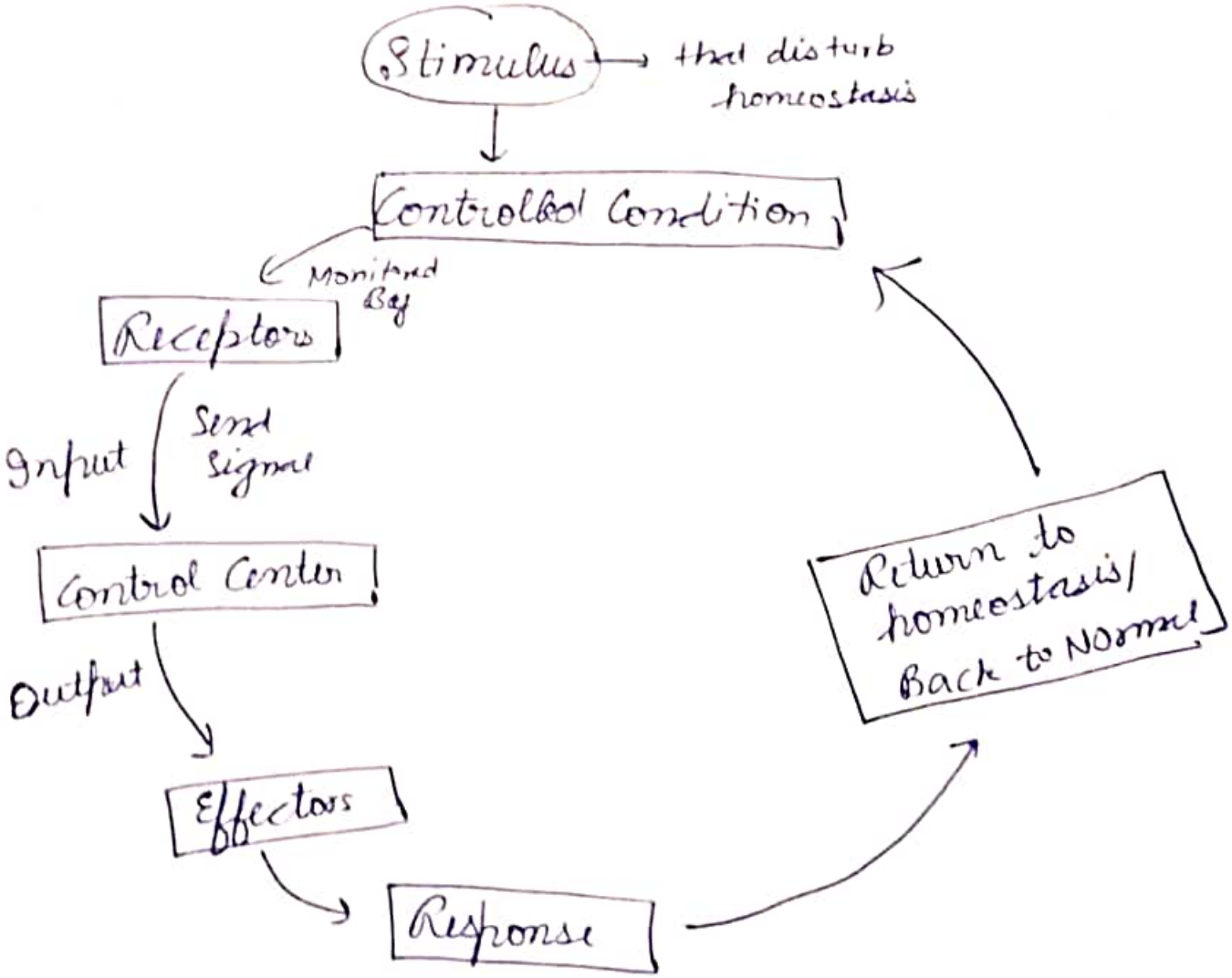
① Receptors :- a Body Structure that detect changes and sends input to the control center.

② Control Center :- It Evaluate the input type and generate an output command when they ~~to~~ Needed

③ Effector :- A body structure that Recieve output and produces Response or effect that changes the Controlled condition.

→ Every organ or tissue in Body behave like as effector.

Exam - When body temperature reduces, your Brain (Control Center) send output (Signal) to the Skeletal muscles (effector) and the muscles Starts Shivering (शिवरी)



Types of Feedback System

Negative Feedback System

Negative Feedback System normally reverses a change in the controlled condition

→ Example - in case of Blood pressure, Body temperature etc.

→ The activity of the stimulus drops by Response of Effector, Control center and Recept.

Positive Feedback System

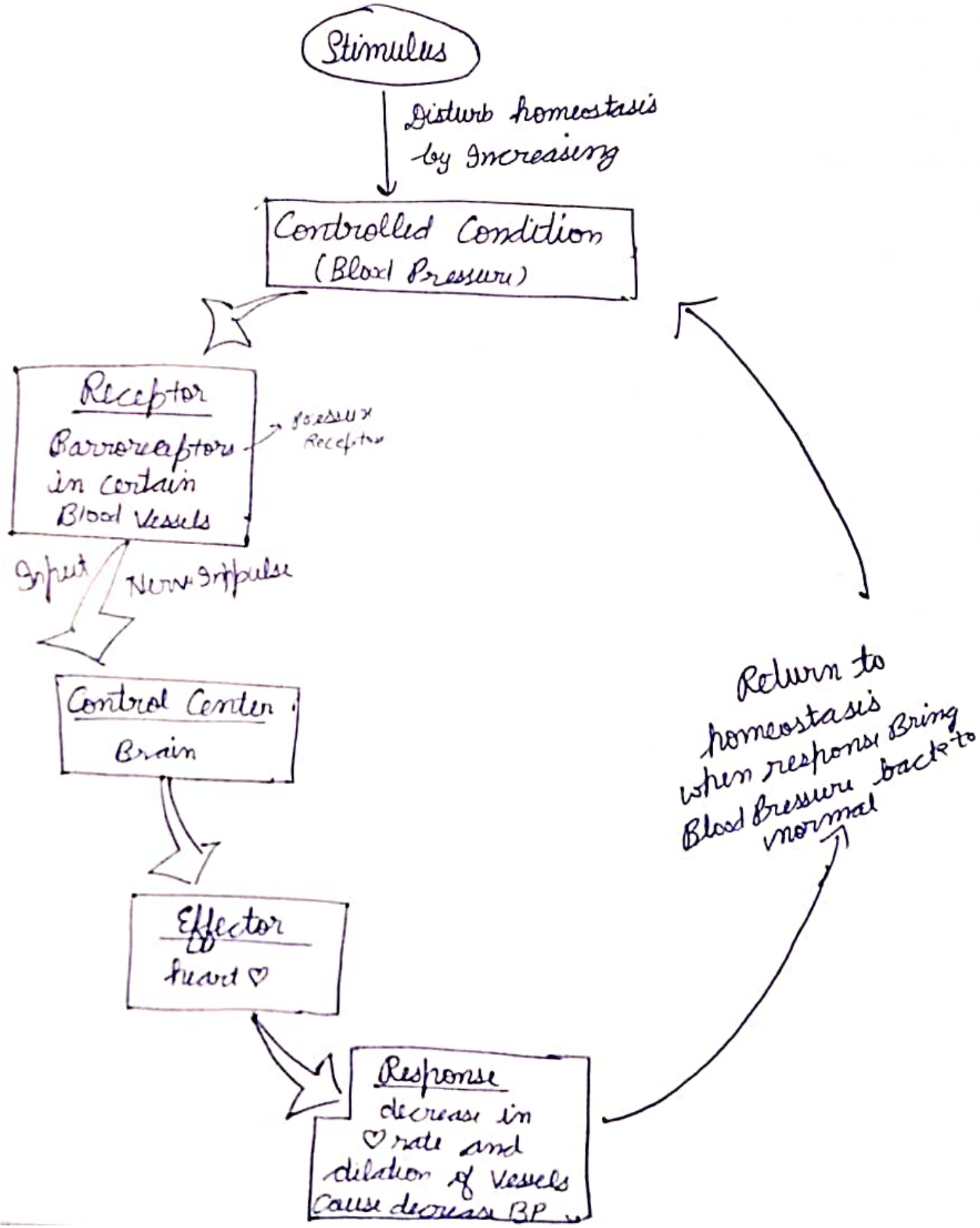
Positive Feedback System tends to enhance a change in Body's controlled Condition.

→ Example - In case of childbirth, Severe loss of Blood etc.

→ The activity of Body leads to enhance the Response of effector, Receptor and control Center

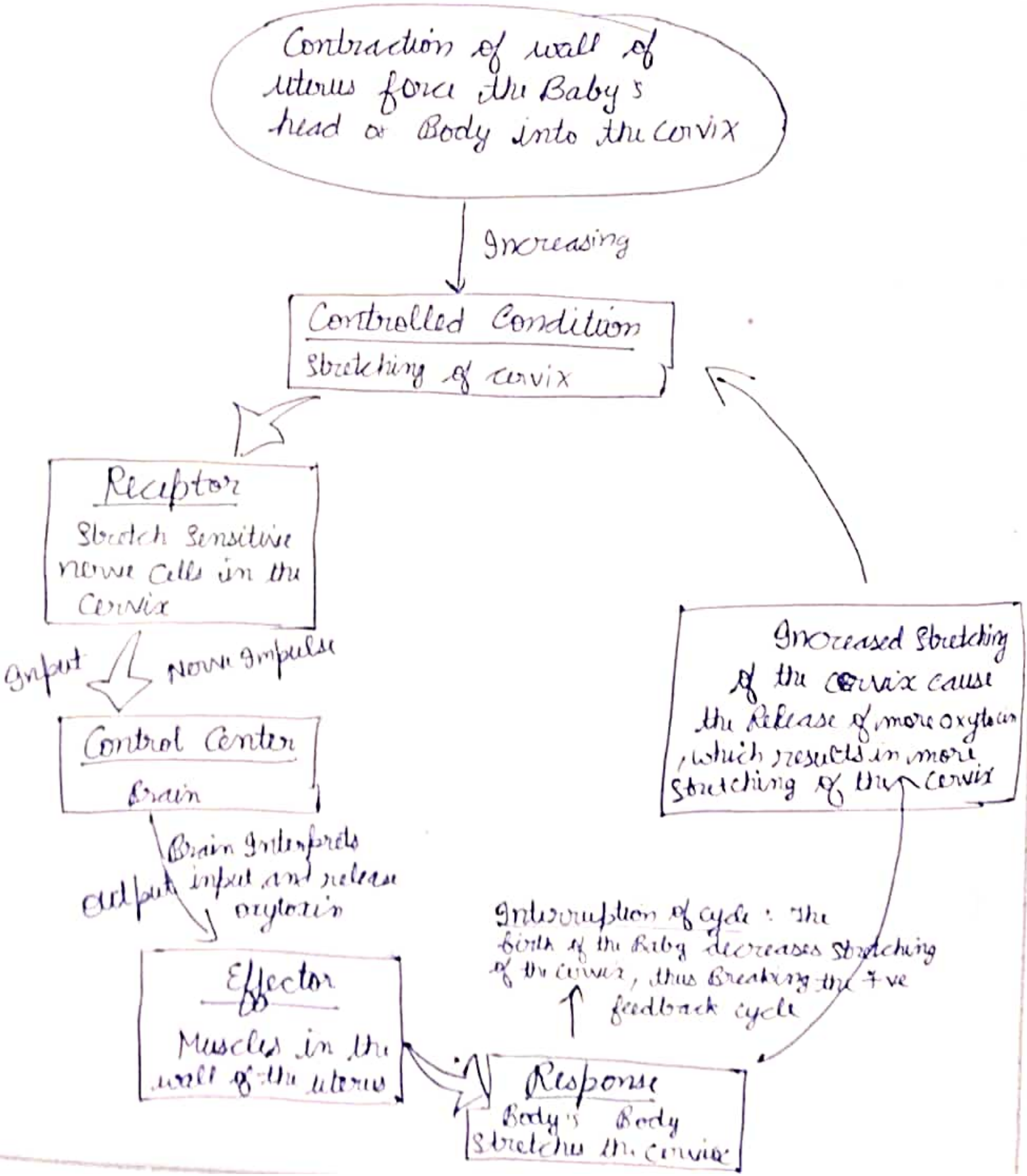
Negative feedback System :-

Homeostatic regulation of Blood Pressure



Positive feedback System :-

Exam - labour Contraction during Baby Birth



Basic Anatomical Terminology

Scientists and health care Professionals are use a common language of special terms. when refering /ideals to body structures and their functions

→ The prevention of the confusion, Standard anatomical position and a special Vocabulary for relating Body parts to one another.

✱ Directional Terms :-

① Superior :- Toward the head or upper part of a structure.

Example - The heart is Superior to the liver.

② Inferior :- Away from the head or lower part of the structure

Example :- The Stomach is Inferior to the lungs

③ Anterior /Ventral :- Near to or at the front of Body

Example :- The Sternum (Breastbone) is anterior to heart.

④ Posterior :- Nearer to or at the back of the Body

Example :- The food pipe is posterior to the windpipe

⑤ Medial :- Nearer to the midline.
(Midline - Imaginary line that divides the Body into Equal right and left Sides)

Example - The Ulna is medial to radius (In Arm)

⑥ Lateral :- Farther from the midline

Example :- The lungs are lateral to the heart.

⑦ Intermediate :- Between two Structures

Example :- The Transverse Colon (Intestine) is intermediate to the ascending and descending Colon.

⑧ Ipsilateral :- On the same side of the Body as another Structure.

Example :- The ascending colon and gall Bladder are ipsilateral

(9) Contralateral :- on the opposite Side of the Body from another structure.

Example :- The ascending and descending colons are contralateral.

(10) Proximal :- Nearer to the attachment of a limb to the trunk ; nearer to the origination of a structure.

Example - The arm bone is proximal to the radium.

(11) Distal :- ~~Farther from the Toward or~~ Farther from the attachment of limb to the trunk

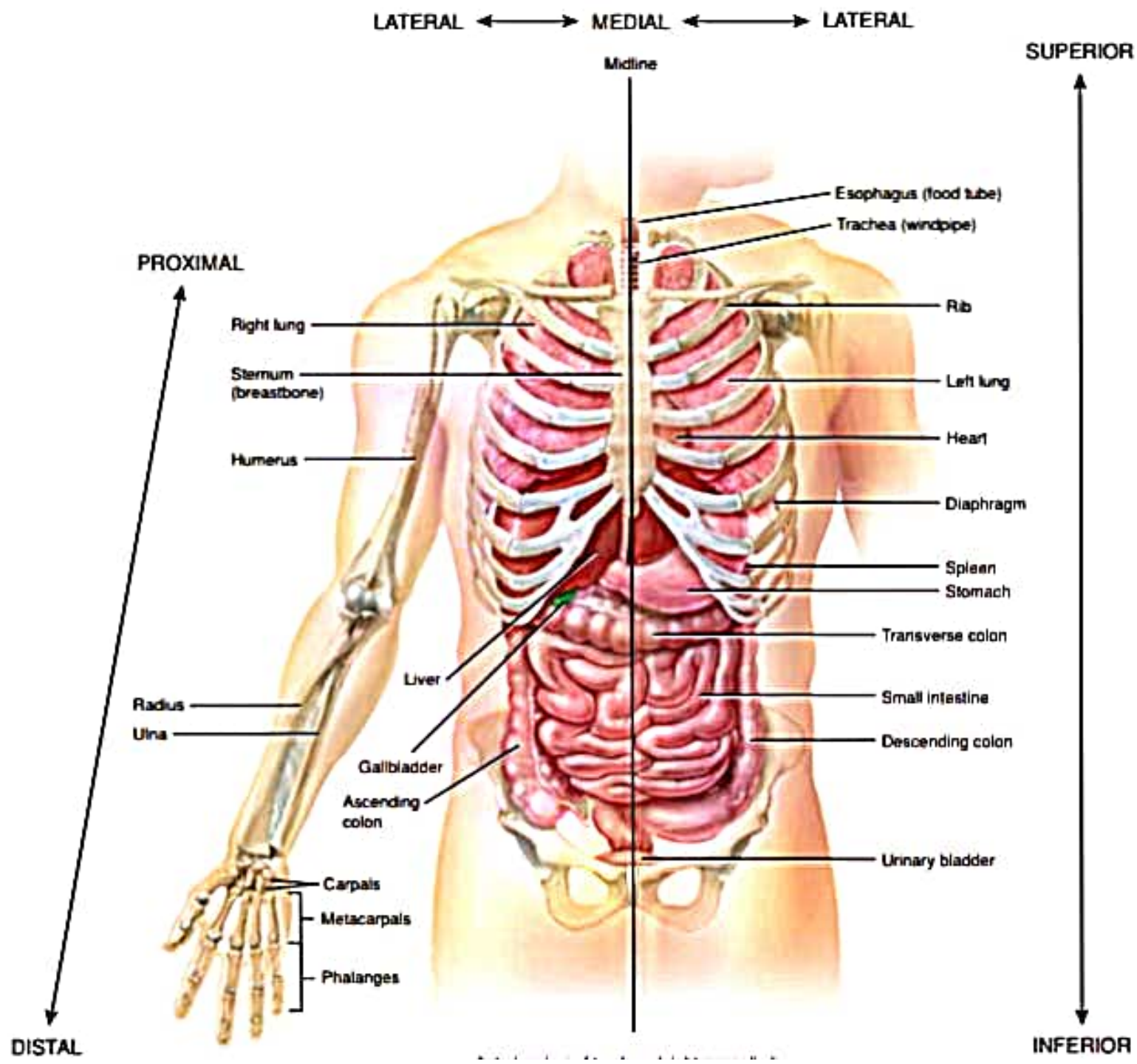
Example :- The finger bones are distal to the Carpals (wrist Bone)

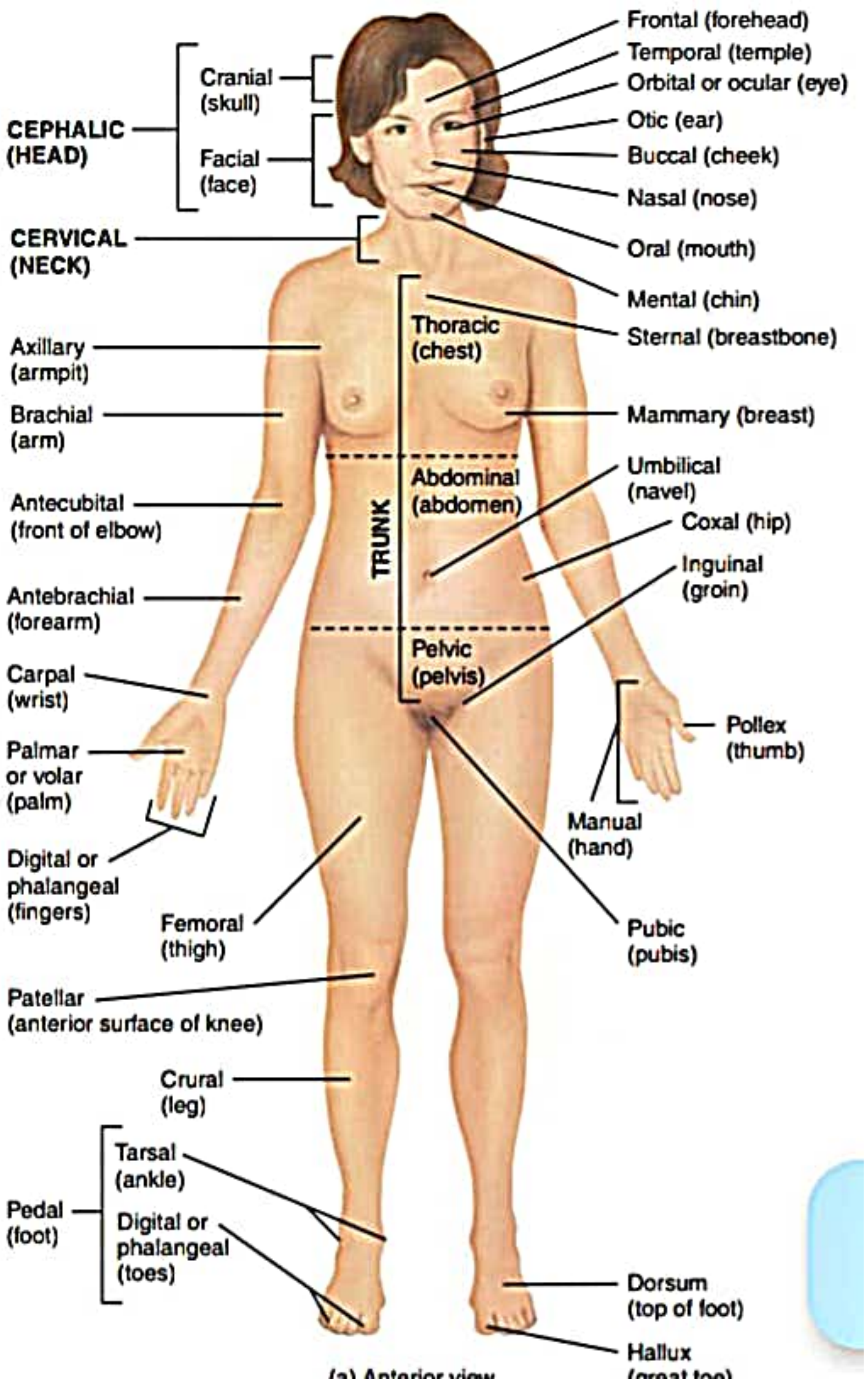
(12) Superficial :- Toward or on the surface of Body.

Example :- The ribs are superficial to lungs.

(13) Deep / Internal :- Away from the surface of Body.

Example :- The ribs are deep to the Skin of the Chest and back

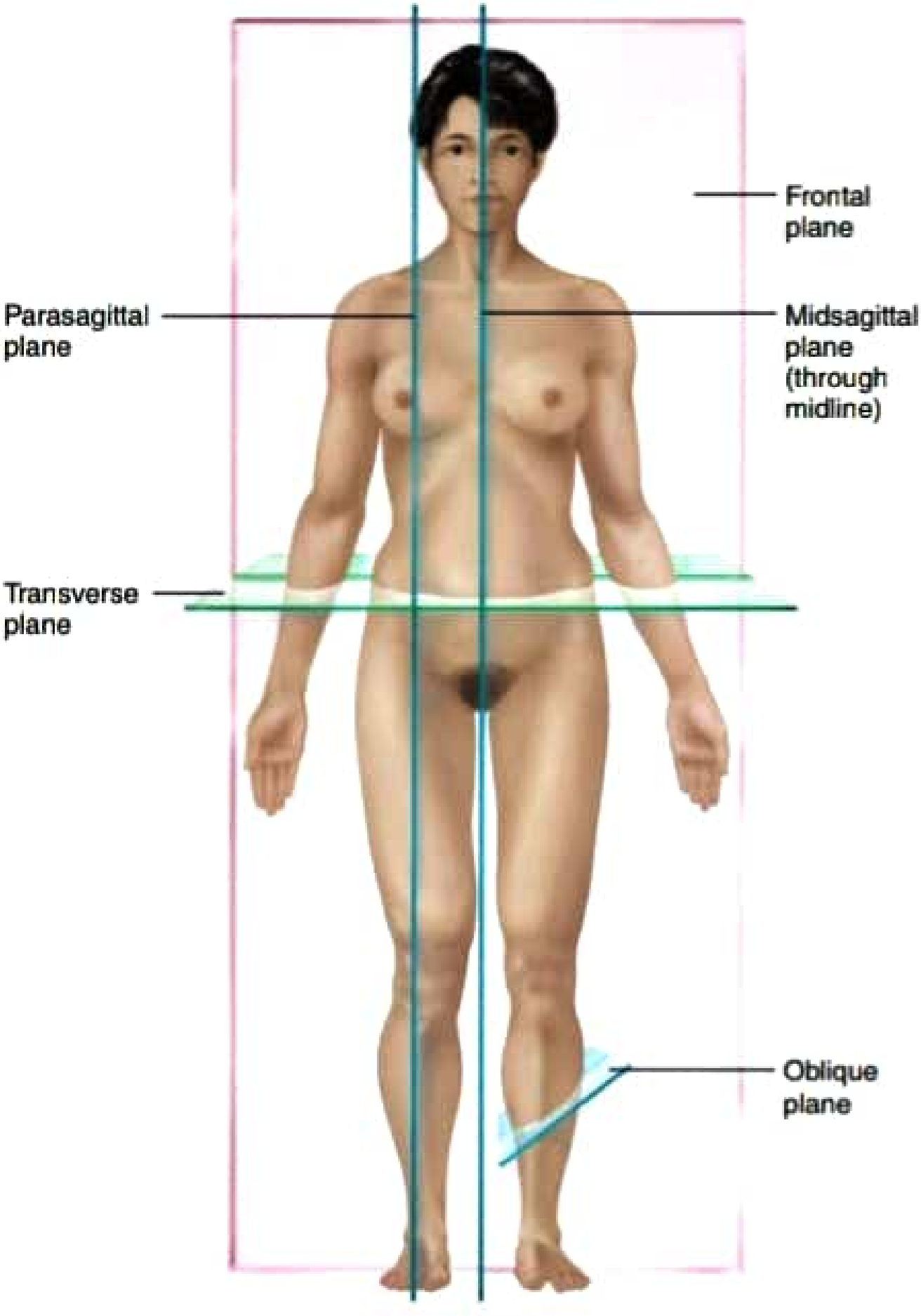

LATERAL
MEDIAL
LATERAL
SUPERIOR
Midline
Esophagus (food tube)
Trachea (windpipe)
PROXIMAL
Rib
Right lung
Sternum
(breastbone)
Left lung
Heart
Humerus
Diaphragm
Spleen
Stomach
Transverse colon
Liver
Small intestine
Radius
Ulna
Descending colon
Gallbladder
Ascending
colon
Urinary bladder
Carpals
Metacarpals
Phalanges
DISTAL
INFERIOR



(a) Anterior view

Figure 1.7 Planes through the human body.

Frontal, transverse, sagittal, and oblique planes divide the body in specific ways.



transverse plane divides the body or an organ into superior (upper) and inferior (lower) portions. Other names for a transverse plane are a **cross-sectional** or **horizontal plane**. Sagittal, frontal, and transverse planes are all at right angles to one another. An **oblique plane** (ō-BLĒK), by contrast, passes through the body or an organ at an oblique angle (any angle other than a 90-degree angle).