CHAPETR 9: Organogenesis (Fate of the Germ Layers)

1. Definition

Organogenesis is the stage of embryonic development where the **three germ layers** (ectoderm, mesoderm, and endoderm), formed during **gastrulation**, begin to **differentiate into organs and body systems**. It begins **after neurulation** and continues throughout the embryonic period.

In the 8 th Week, the most major organs are present in basic form and after this period, the embryo is called a **fetus**, and the organs grow and mature (fetal period).

2. Stages / Process of Organogenesis:

1. **Cell Differentiation**
    - Cells in each germ layer become specialized for specific roles.
2. **Induction**
    - Certain cells **signal** neighboring cells to form specific tissues or organs.
    - Example: notochord induces ectoderm to form the neural tube.
3. **Morphogenesis**
    - Organs take shape through **folding, budding, fusion**, and **growth** of tissues.
4. **Organ System Formation**
    - Each organ system begins to form:
        - **Nervous system** from ectoderm (neurulation)
        - **Circulatory system** from mesoderm (heart forms early)
        - **Digestive and respiratory systems** from endoderm

3. Fate of germ layers

1. Ectoderm (outer layer)

Main fate: **Skin** and **Nervous System**

Ectoderm Derivatives	Description
Epidermis	Outer layer of skin, hair, nails
Central nervous system (CNS)	Brain and spinal cord
Peripheral nervous system (PNS)	Nerves outside the CNS
Sensory organs	Eyes (lens, retina), ears, nose
Tooth enamel	Hard outer covering of teeth
Mammary and sweat glands	Skin-associated glands

2. Mesoderm (middle layer)

Main fate: **Muscles**, **Bones**, **Heart**, **Blood**

Mesoderm Derivatives	**Description**
Muscular system	Skeletal, cardiac, smooth muscle
Skeletal system	Bones and cartilage
Circulatory system	Heart, blood vessels, blood cells
Excretory system	Kidneys, ureters
Reproductive system	Gonads (ovaries, testes), uterus
Dermis	Inner layer of skin
Notochord	Precursor to the vertebral column
Adrenal cortex	Outer layer of adrenal glands

3. Endoderm (inner layer)

🔻 **Main fate**: **Digestive and Respiratory Systems**

Endoderm Derivatives	**Description**
Lining of digestive tract	From pharynx to anus
Liver and pancreas	Digestive glands
Lining of respiratory tract	Trachea, bronchi, lungs
Thyroid and parathyroid glands	Endocrine glands
Urinary bladder and urethra	Lower urinary tract
Tonsils and thymus	Immune system organs