Chapter 02: Embryogenesis

The third week of embryonic development

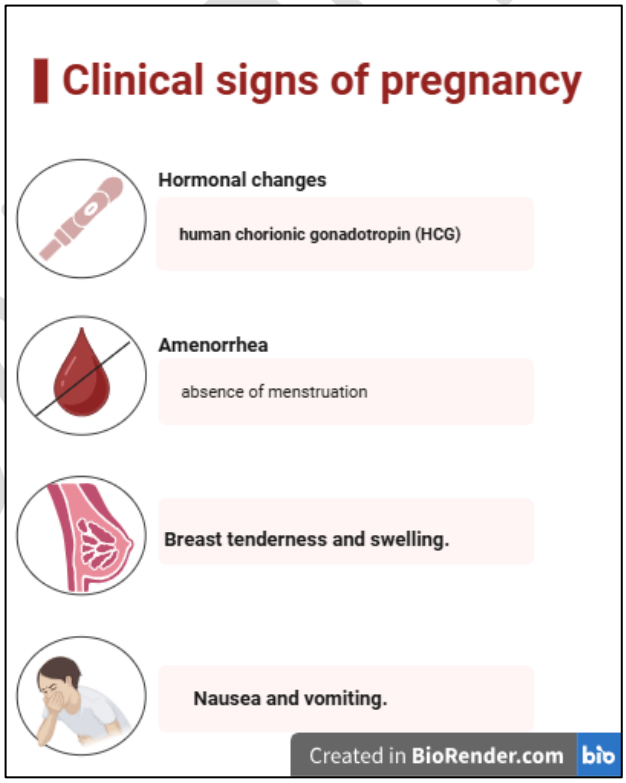
The third week of embryonic development is a crucial stage marked by significant transformations in embryonic organization. This phase sees the establishment of gastrulation, neurulation, and the beginning of the development of embryonic annexes. It is critical as it marks the transition from a two-layer embryo (bilaminar embryonic disc) to a three-layer structure (trilaminar embryonic disc) with three distinct germ layers: ectoderm, mesoderm, and endoderm. These layers will give rise to the various organs and tissues of the future organism.

1. Maternal Changes

1.1 Clinical Changes

By the third week, clinical signs become noticeable in the mother. Notable indicators include:

- **Amenorrhea**: This is the first tangible clinical sign of pregnancy.
- **Physiological Manifestations**: By the end of the third week, additional symptoms appear, including:
    - Breast tenderness and swelling.
    - Nausea and vomiting.
    - Constipation and frequent urination (pollakiuria).



1.2 Biological Changes

On a biological level, the secretion of **human chorionic gonadotropin (HCG)**, produced by the syncytiotrophoblast, plays a crucial role:

- It ensures the maintenance of the **corpus luteum**, which then becomes a **gestational corpus luteum** and continues secreting progesterone, an essential hormone for sustaining pregnancy.

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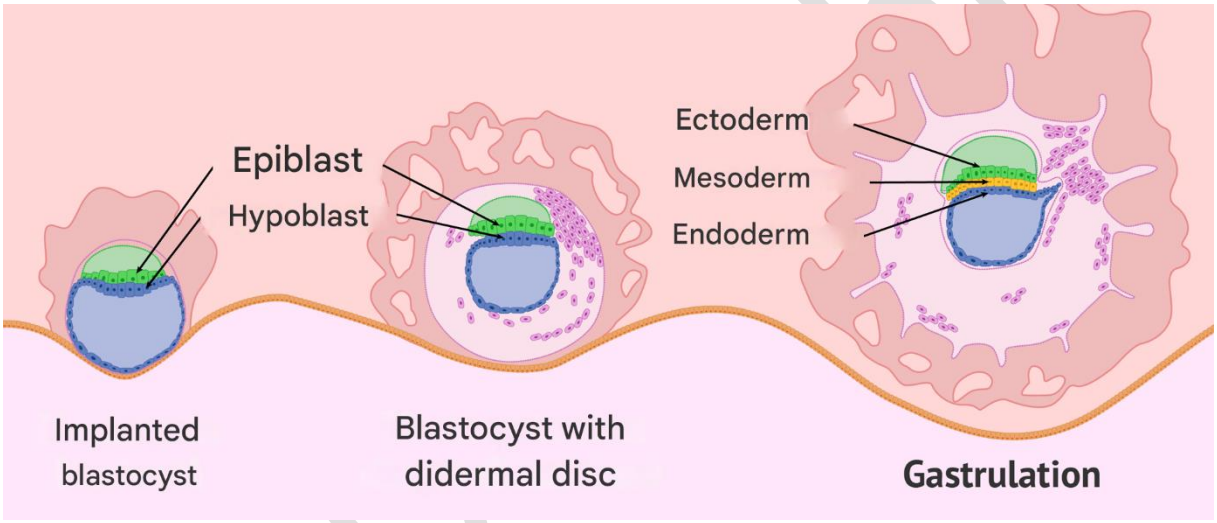
- It is excreted in maternal urine in sufficient quantities to allow early pregnancy detection.

2. Embryonic Disc Changes

2.1 Formation of the Trilaminar Disc

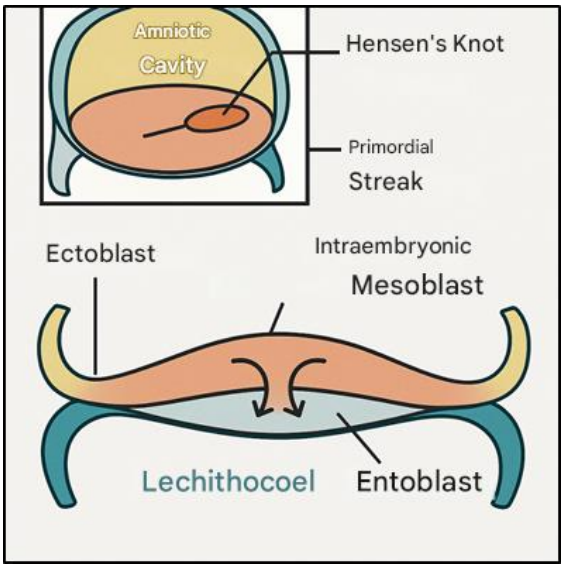
The transformation of the bilaminar embryonic disc into a **trilaminar disc** is a decisive milestone. This new structure consists of three distinct germ layers:

1. **Ectoderm**: It will give rise to the skin, nervous system, and parts of sensory organs.
2. **Mesoderm**: It will develop into the musculoskeletal system, kidneys, circulatory system, and reproductive organs.
3. **Endoderm**: It will form the digestive and respiratory mucosae and various glands.



2.2 Gastrulation

Gastrulation is a complex mechanical process during which cells migrate and organize to form the three germ layers. This transformation is orchestrated by the appearance of the **primitive streak**, an essential structure located in the caudal region of the embryonic disc.



- **Day 15**: The primitive streak forms, initiating cell migration.
- **Day 16**: The **Hensen's node** appears, playing a crucial role in embryonic organization.
- **Days 17-19**: Differentiation of the **intra-embryonic mesoderm**.

2.3 Formation of the Notochord

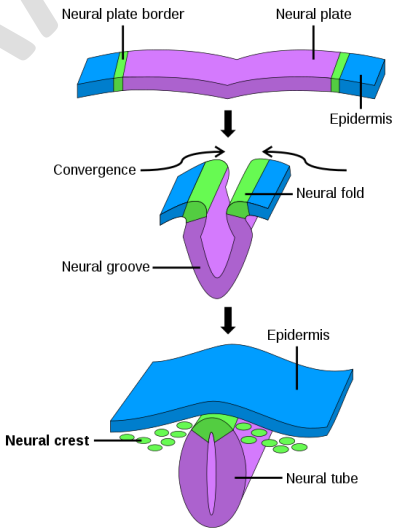
The **notochord** is an essential structure for the axial development of the embryo. It originates from the **chordal process**, a cellular cord forming between the ectoderm and endoderm. Its roles include:

- Ensuring the embryo's symmetry.
- Inducing the formation of nervous structures.
- Prefiguring the future axial skeleton.

2.4 Neurulation

Neurulation is a key process that leads to the formation of the **neural tube**, the precursor of the central nervous system. This phenomenon follows several stages:

1. **Days 18-19**: The ectoderm transforms into the **neural plate** under the inductive influence of the notochord.
2. **Day 20**: Formation of the **neural groove**, which will gradually close.
3. **End of the third week**: Closure and isolation of the **neural tube**.



3. Development of Embryonic Annexes

3.1 Formation of Blood Vessels

The embryonic circulatory system begins to develop from blood islands located in the extra-embryonic mesenchyme. These **Wolff and Pander islands** play a crucial role in the formation of the first erythroblasts, precursor cells of red blood cells.

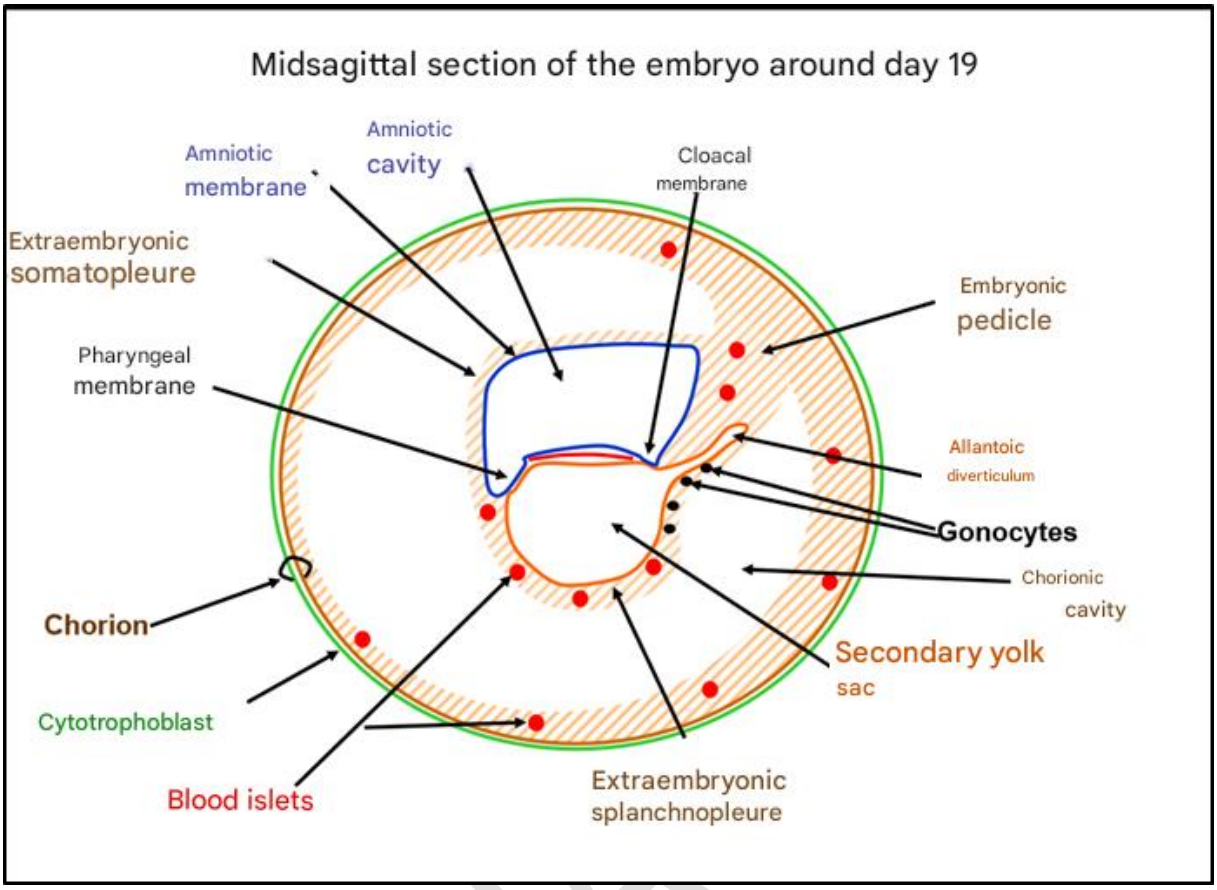
3.2 Formation of the Allantois

By **Day 16**, the **secondary yolk sac** extends a projection toward the **embryonic stalk**, forming the allantois. This structure is crucial for vascular development and the formation of the future umbilical cord.

3.3 Emergence of Primordial Germ Cells

Around **Day 18**, primordial germ cells appear in the **extra-embryonic mesenchyme** near the allantois. These cells will later migrate to the developing gonads to initiate the germ cell lineage.

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Conclusion

The third week of embryonic development is a pivotal phase in the morphogenetic organization of the human embryo. The completion of gastrulation, formation of the notochord and neural tube, and establishment of the first vascular and germinal structures are all fundamental events that prepare the embryo for organogenesis.

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