



Embryology
team
438



Lecture 1: Introduction to Embryology

Colour Index:
Red: Important
Gray: Dr.'s notes
Green: Extra notes

After this lecture you should be able to:

- Define Embryology.
- Define the developmental periods.
- Define the significance of embryology.
- Define the different embryological terminology.
- Define the nomenclature used to describe body parts, positions, and relationships.
- Describe in brief the important events in embryology.

Definition and Significance of Embryology

→ Definition of Embryology:

- ❖ **Embryology** generally refers to the **prenatal** (قبل الولادة) **development** of embryos and fetuses.
- ❖ “**Human embryology**” is the science concerned with the origin and development of a human being **from a zygote to birth of an infant**.
- ❖ Development does not stop at birth. Important changes in addition to growth occur after birth (postnatal changes) e.g. development of teeth and female breasts.

تعريفين

→ Importance of Embryology:

- ❖ The study of prenatal stages of development, especially those occurring during the embryonic period, help us **understand the normal body structure and the cause of congenital anomalies**.
- ❖ It is also concerned with studying various **genetic and environmental factors** that **disturb normal development and produce birth defects**.

→ Developmental Periods

Prenatal development:

Includes the main developmental changes occurring **before birth**, and is divided into 2 periods:

Postnatal development:

Includes changes occurring **after birth**. e.g. teeth and breast.

Embryonic period:

Begins at **fertilization** and ends with the **end of the 8th week**.

(called an embryo)

Fetal period:

Begins at the **beginning of the 9th week** and ends at **birth**.

(called a fetus)

Note:

Prenatal development is more rapid than postnatal development and results in more striking changes.

Note:

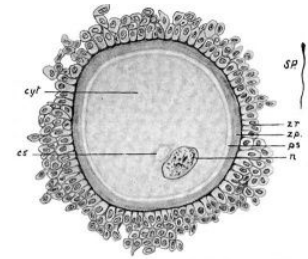
The most critical period is the **embryonic period**.

→ Critical Periods of Human Development:

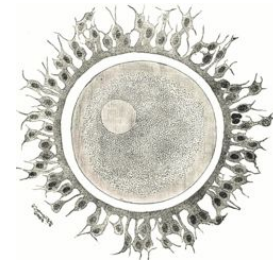
- It is the stage of development of an embryo that is **susceptible to an agent**, such as a drug or virus, which can lead to **congenital abnormalities**.
- The development of the embryo is most easily disrupted when the tissues and organs are forming during the **embryonic period**.

Common terms

- **Oocyte**; the immature ovum, female germ cell.
- **Ovum**; the mature female germ cell.
- **Sperm**; the mature male germ cell.
- **Zygote**; the fertilized ovum.
- **Cell division**; one cell divides into two cells; there are two types of cell division:
 - **A- Mitotic**; the cell produces 2 cells each contains 44 autosomes and 2 sex chromosomes
 - **B- Meiotic**; (reduction) it occurs in the primitive germ cells in the testes or the ovaries, it produces 2 cells each contains 22 autosomes and one sex chromosomes.



oocyte

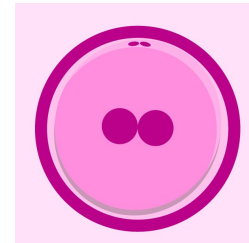


ovum



sperm

Cell division



zygote

Descriptive terms

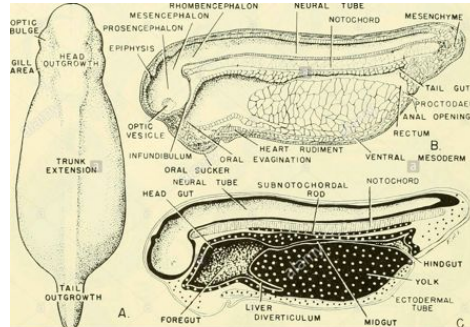
→ Directions:

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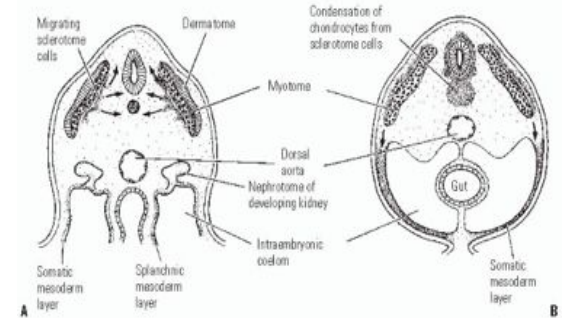
- **Cranial**; the **top** of the embryo or the head.
- **Cephalic**; **superior** or the head.
- **Caudal**; **inferior** or the tail end.
- **Dorsal**; **back** of the embryo.
- **Ventral**; **anterior** or the belly side.
- **Medial**; **near** to the midline.
- **Lateral**; **flank** side.

→ Planes and sections:

- **Longitudinal**; **median** or **sagittal**. (cuts it to left & right)
- **Coronal**; **frontal**.
- **Transverse**; **horizontal**. (cuts it to superior & inferior)



Longitudinal



Transverse; horizontal

Major events during the embryonic period

- Gametogenesis → occurs at 1st week.
- Fertilization → occurs at 1st week.
- Implantation → begins one week after fertilization.
- Development of the Central Nervous System (CNS; brain & spinal cord) → occurs at 3rd week.
- Embryonic Folding → occurs at 4th week.

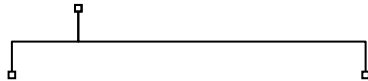
Note:

The Bilaminar & Trilaminar discs are supposed to be present before the embryonic folding.

Gametogenesis

- It is the production of **mature gametes (sperm and ovum)** by **gonads (testes in males and ovaries in females)**.

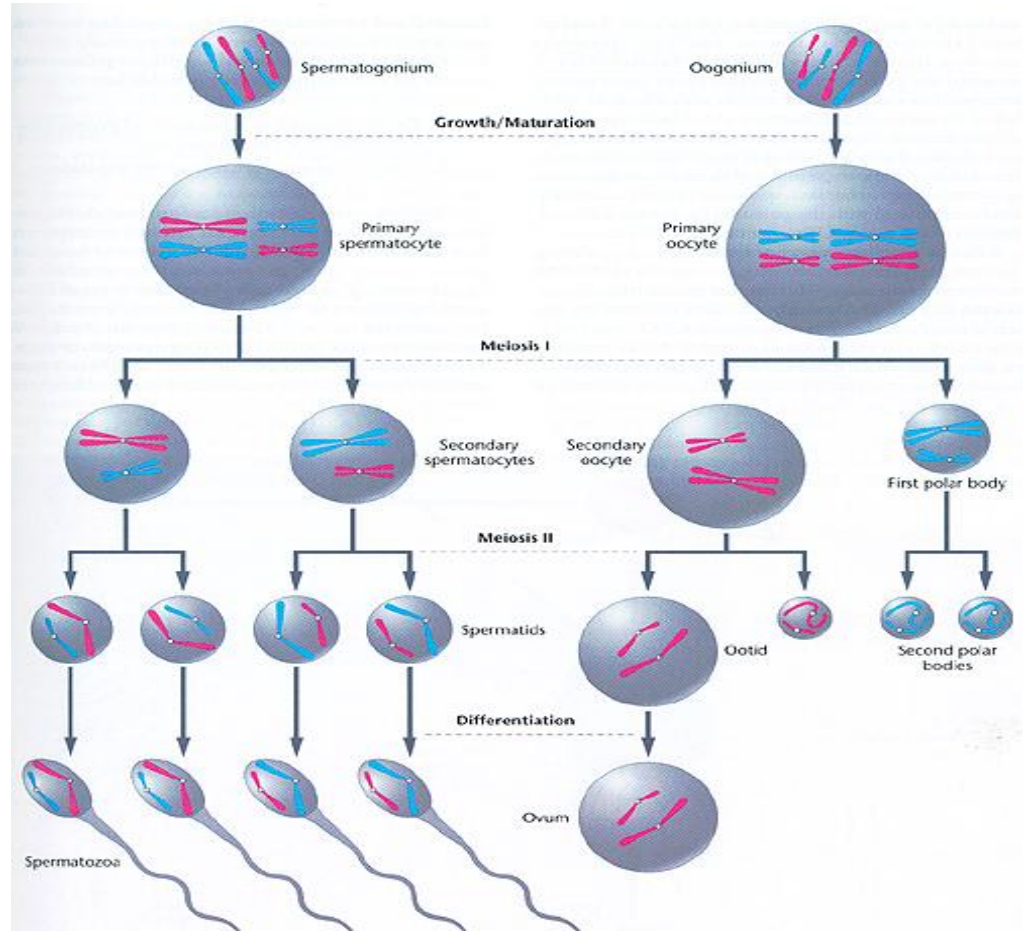
- Gametogenesis



- 1- Spermatogenesis 2- Oogenesis

Note:

- Spermatogonium and Oogonium are immature gametes (germ cells).
- **Meiosis** occurs in gametogenesis.



Gametogenesis in males and females	Spermatogenesis (Males)	Oogenesis (Females)
Definition	It is the process of formation of mature sperms	It is the process of formation of mature ovum
Site	takes place in the seminiferous tubules in the testis	occurs in the cortex of the ovary
Duration	occurs continuously from puberty till old ages	starts during fetal life , continues after puberty, and fertilization, till menopause
Result	1- Reduction of chromosomal number from the diploid to the haploid number. 2- Change the germ cell (spermatogonium) to the motile (mature) sperm. 3- Increase the number of the sperms.	It ends with a haploid (23 chromosomes) number of chromosomes

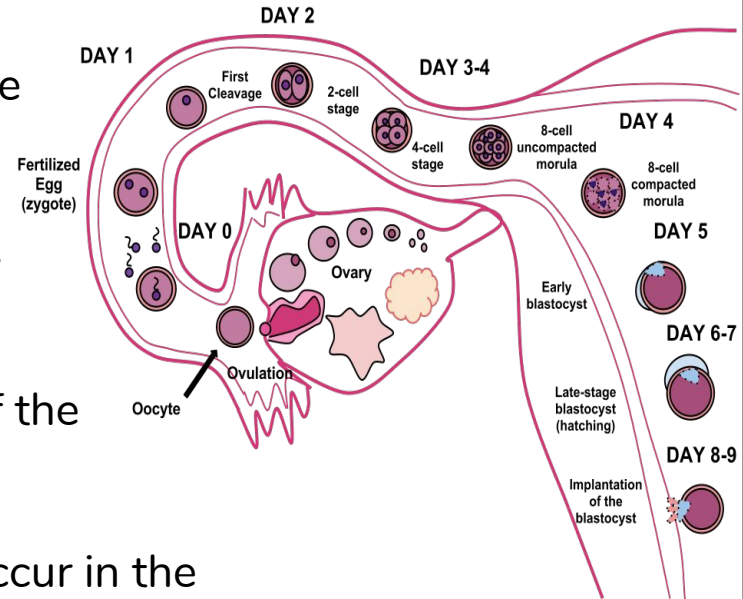
Fertilization:

- It is the process in which a male gamete (**sperm**) unites with a female gamete (**ovum**) to form a single cell (**zygote**).
- Site: It occurs in the uterine tube.

Implantation:

It is the process of embedding of the blastocyst in the endometrium of the uterus.

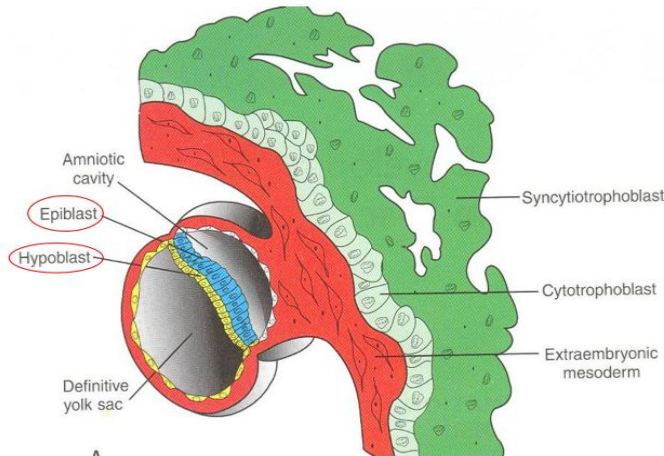
- It begins one week after fertilization.
- It is completed by the 12th day after fertilization.
- Sites of implantation:
 - 1- Normal site of implantation:
In the **upper part of the posterior surface** of the uterus near the funds.
 - 2- Abnormal site of implantation (**ectopic pregnancy**): Most of ectopic pregnancies occur in the **uterine tube**.



Bilaminar disc:

It is the differentiation of the cells into two layers (in the 2nd week of pregnancy):

- **Epiblast:** High **columnar** cells adjacent to the amniotic cavity. (**Dorsal**)
- **Hypoblast:** Small **cuboidal** cells adjacent to Yolk sac. (**Ventral**)

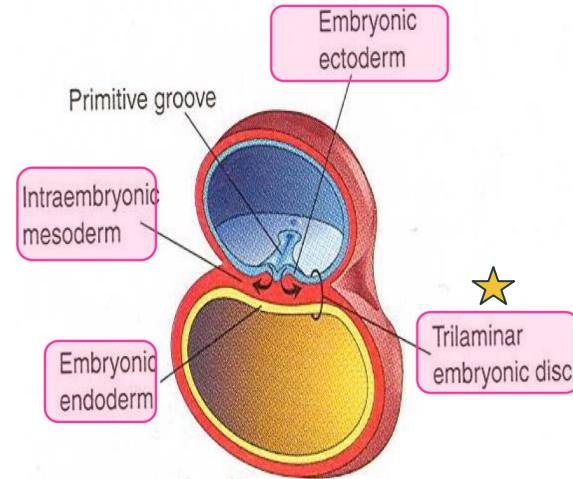


Trilaminar disc:

The embryonic disc is formed of 3 layers (in the 3rd week of pregnancy):

- Embryonic Ectoderm
- Intraembryonic Mesoderm.
- Embryonic Endoderm.

Cells in these layers will give rise to **all tissues and organs** of the embryo.



MCQs

1- "Human embryology" is the science concerned with the origin and development of a human being from:

A- birth to puberty B- sperm and ovum to zygote C- a zygote to birth of an infant D- 6th week to birth

2- When does the implantation process begin and end?

A- Fertilization to 8th week B- Beginning of week 2 till the 12th day C- 12th day to birth D- Fertilization to the end of the First week

3- Epiblast layer is adjacent to

A- Amniotic cavity B- posterior surface of the uterus C- Yolk cavity D- Cortex of the ovary

4- Where does the spermatogenesis occur?

A- Cortex of Ovary B- Endometrium C- Epididymis D- Seminiferous tubules

5- What is the term used to express the anterior direction in Embryology?

A- Frontal B- Caudal C- Ventral D- Sagittal

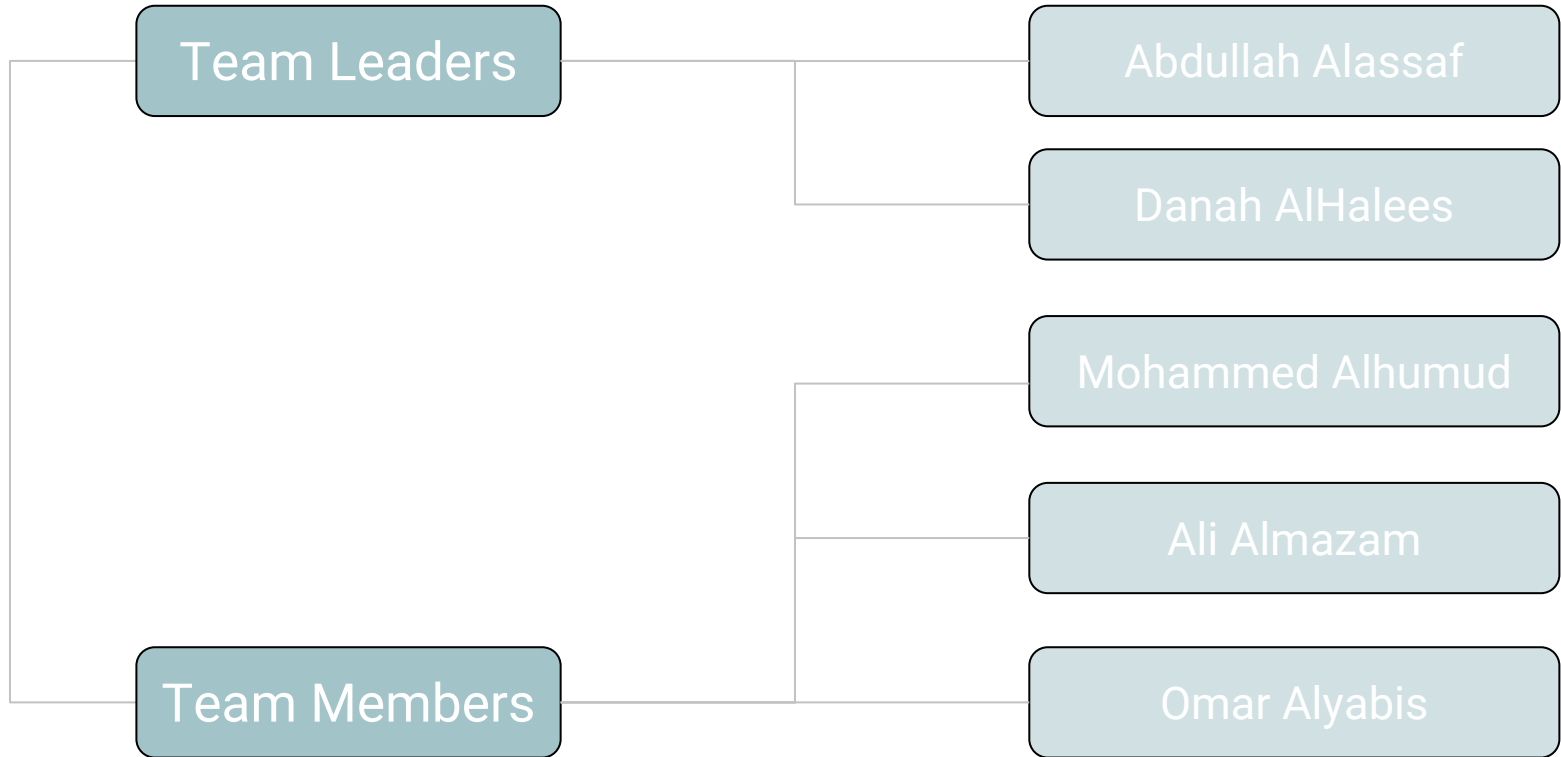
6- Slower changes occur during which period?

A- Prenatal B- Postnatal C- Embryonic D- Fetal

7- An example of a Postnatal development is?

A- Development of CNS B- Formation of limbs C- Formation of teeth

Answers : 1C / 2B / 3A / 4D / 5C / 6B / 7C



Special thank you to: Abeer Alkhodair & Haifa Alwaily

Thank you