

Introduction to embryology

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Objectives

- **After this lecture you should be able to :**
- **Define** Embryology.
- **Define** the developmental periods.
- Define the **significance** of embryology.
- **Knew** the different embryological terminology.
- **Define** the nomenclature used to describe body parts, positions, and relationships.
- **Describe in brief** the important events in embryology.

Definition of Embryology

- This term generally refers to **prenatal 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**.

SIGNIFICANCE OF EMBRYOLOGY

Importance of Embryology :

- The study of **prenatal stages of development**, especially those occurring during the embryonic period to understand the **normal body structure** and the **causes of congenital anomalies**.
- So,It is concerned with **various genetic and /or environmental factors** that disturb the normal development producing birth defects.

Developmental periods :

- Developmental periods are divided into :

1- Prenatal development :

It is the main developmental changes occurring before birth, including :

- The embryonic period : starts from the fertilization to the end of 8th week.
- The fetal period : begins from the 9th week until birth.

2- postnatal development :

The changes occurring after birth, like **teeth** and **breast**.

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

Critical Periods of Human Development

- This 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**.
- **Embryological Development** is most easily disrupted when the tissues and organs are forming **during the embryonic period**.

Common terminology :

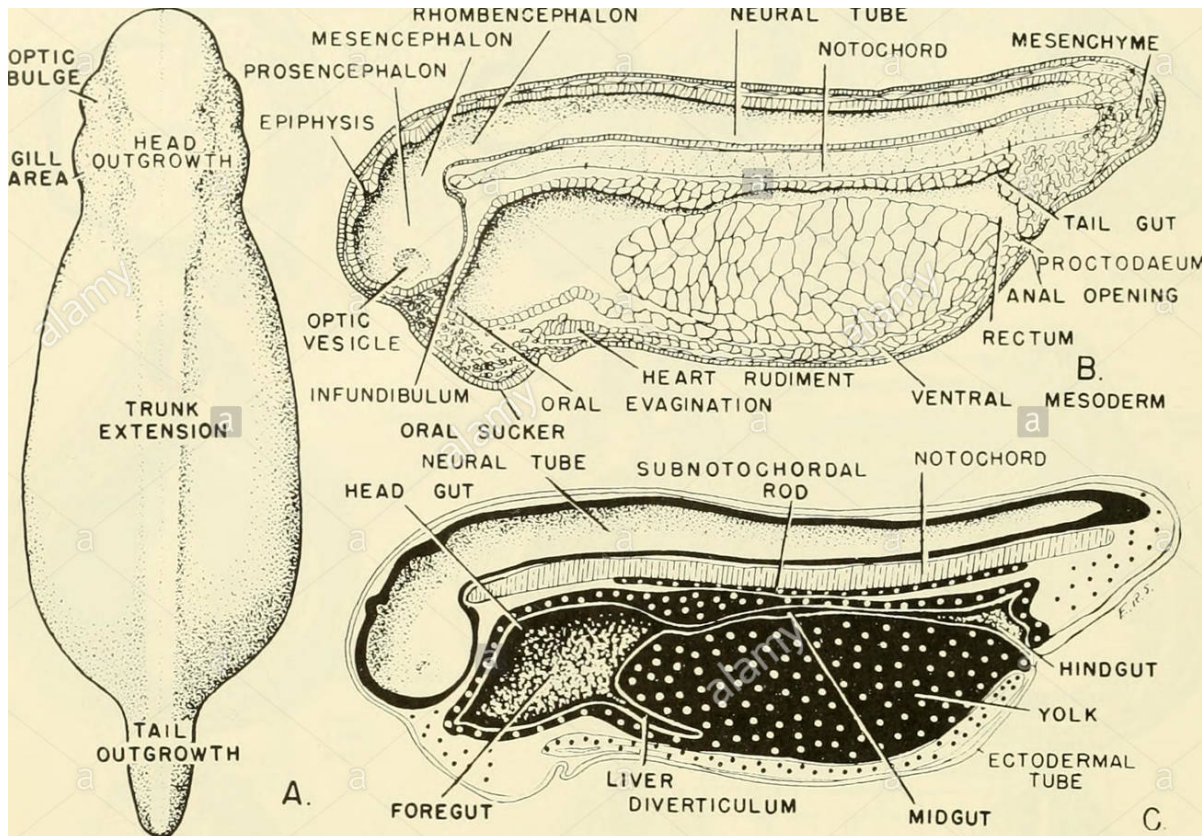
- **Oocyte**; the immature ovum or female germ cell.
- **Ovum**; the mature female germ cell.
- **Sperm**; the mature male germ cell.
- **Zygote**; the fertilized ovum.
- **Cell division** : one cell divides into two cells; there are two types of cell division:
 - **A- Mitotic** : **It occurs in** the somatic cell, **it produces** 2 cells each contains 44 autosomes and 2 sex chromosomes (**Diploid number** of chromosomes).
 - **B- Meiotic (reduction)** : **It occurs in** the primitive germ cells in the testes or the ovaries, it includes 2 stages 1st & 2nd meiotic divisions, **it produces** 2 cells each contains 22 autosomes and one sex chromosomes (**Haploid number** of chromosomes).

Descriptive Terms of the embryo :

- **Related to the Directions:**
- 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.

Descriptive Terms:

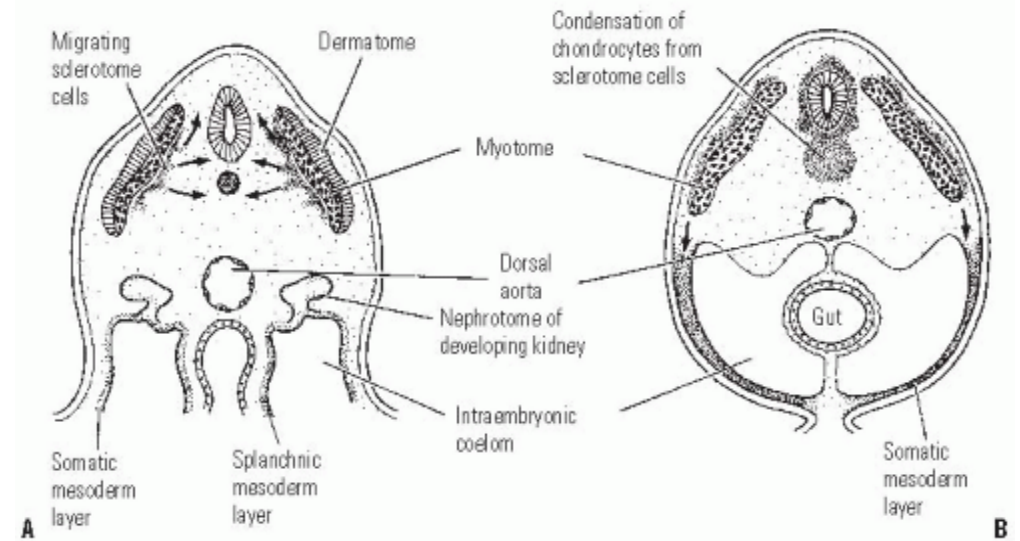
- Plans of sections:
- Longitudinal; median or sagittal.
- Coronal; frontal.
- Transverse; horizontal



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Longitudinal Section



Transverse; horizontal

Development of the Palate

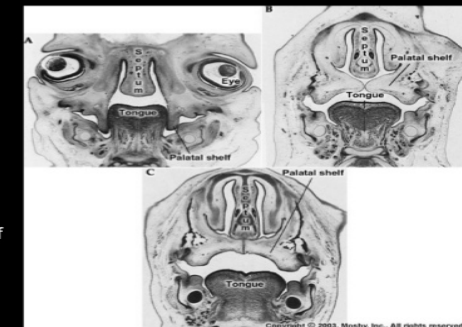
8-12 weeks in utero

Coronal sections through human embryos at approximately

(A) 7 weeks (initial disposition of palatine shelves on each side of the tongue)

(B) 8 weeks (elevation coincident with depression of the tongue)

(C) 9 weeks (final fusion)



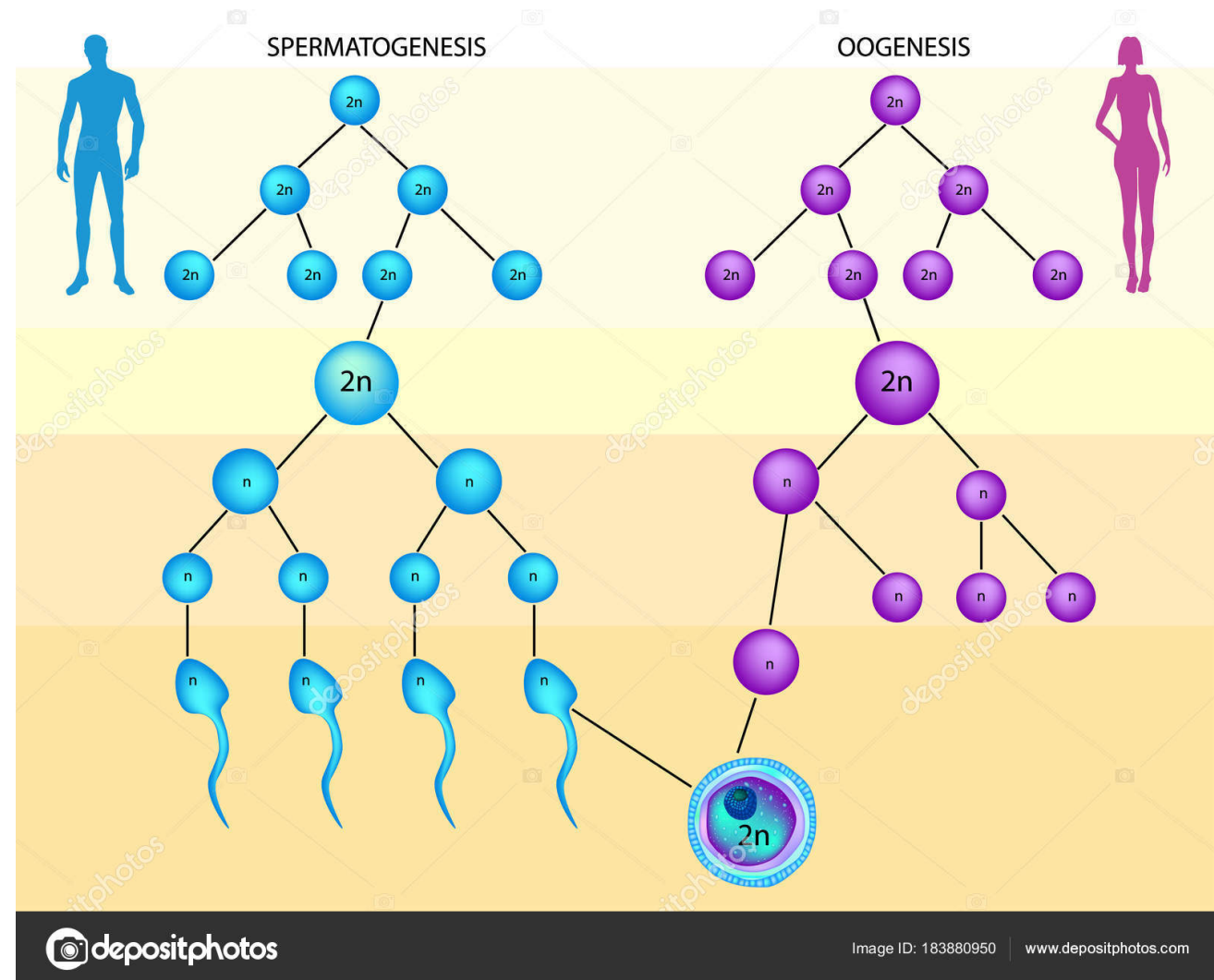
Coronal Section

Major events during embryonic period

- Gametogenesis : occurs at 1st week.
- Fertilization : 1st week
- Implantation : begins one week after fertilization
- Development of the Central Nervous System : 3rd week
- Embryonic Folding : 4th week

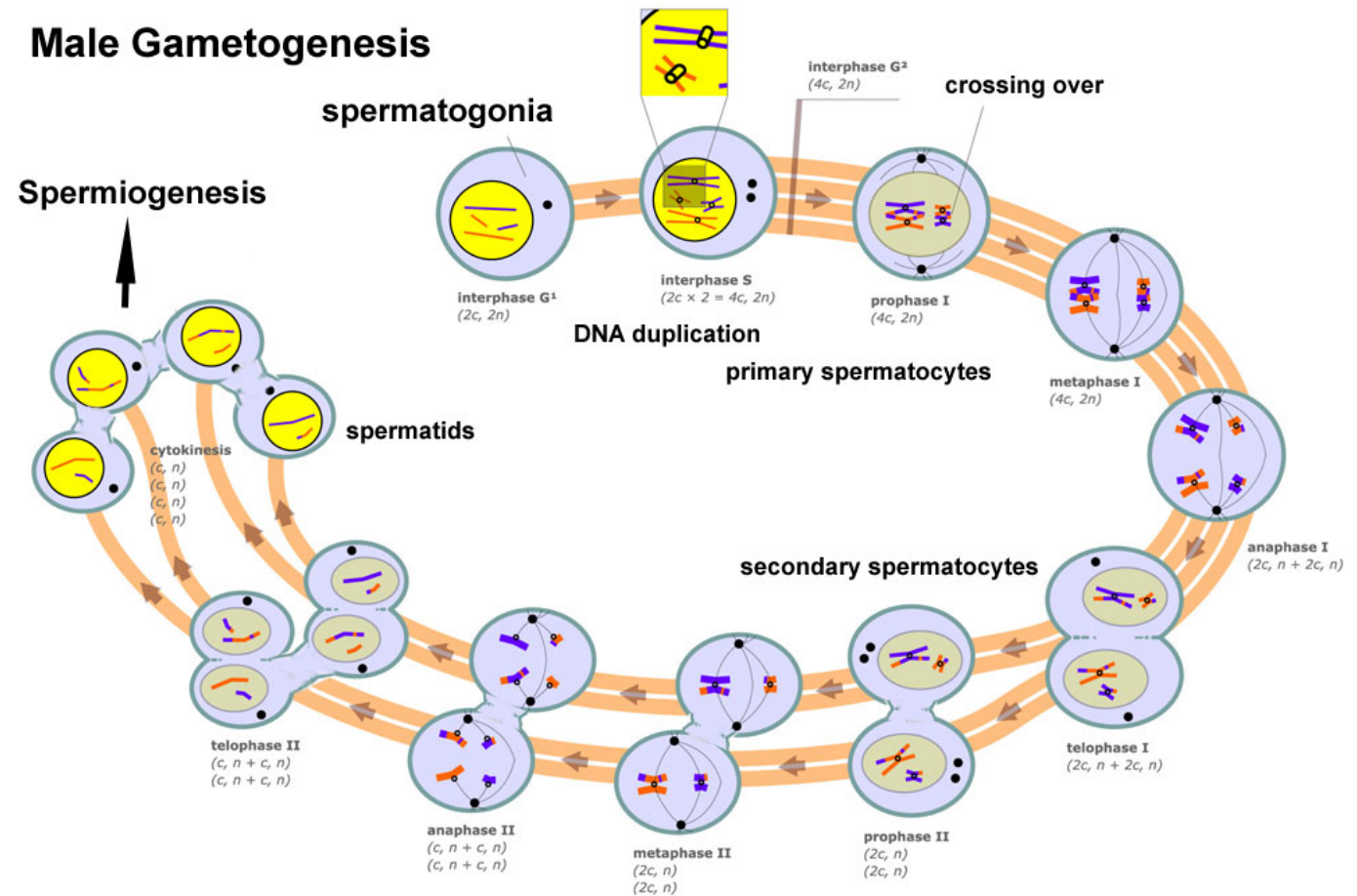
GAMETOGENESIS

- It is the **production of mature gametes** (sperm and ova) by gonads (testes in males and ovaries in females).
- It is divided into:
 - 1- Spermatogenesis.
 - 2- Oogenesis.



SPERMATOGENESIS

- It is the process of formation of mature sperms,
- **Occurs** in the **seminiferous tubules**,
- **Starts** from puberty till old ages.
- **It ends** by haploid number of chromosomes.

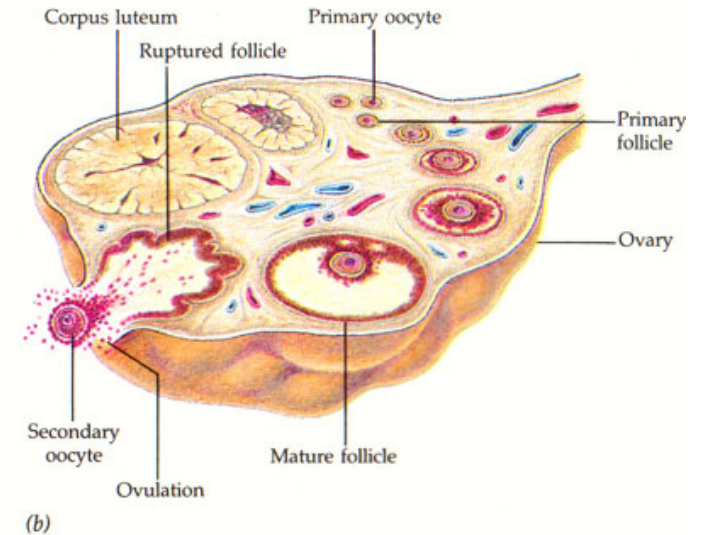
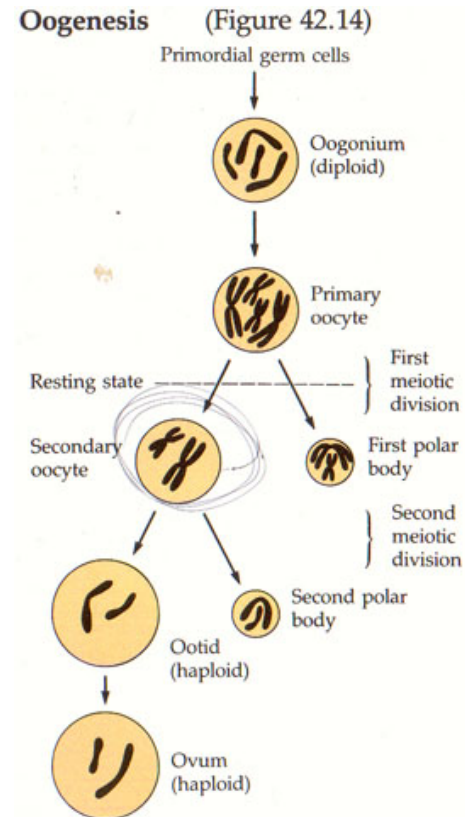


- Results of spermatogenesis;

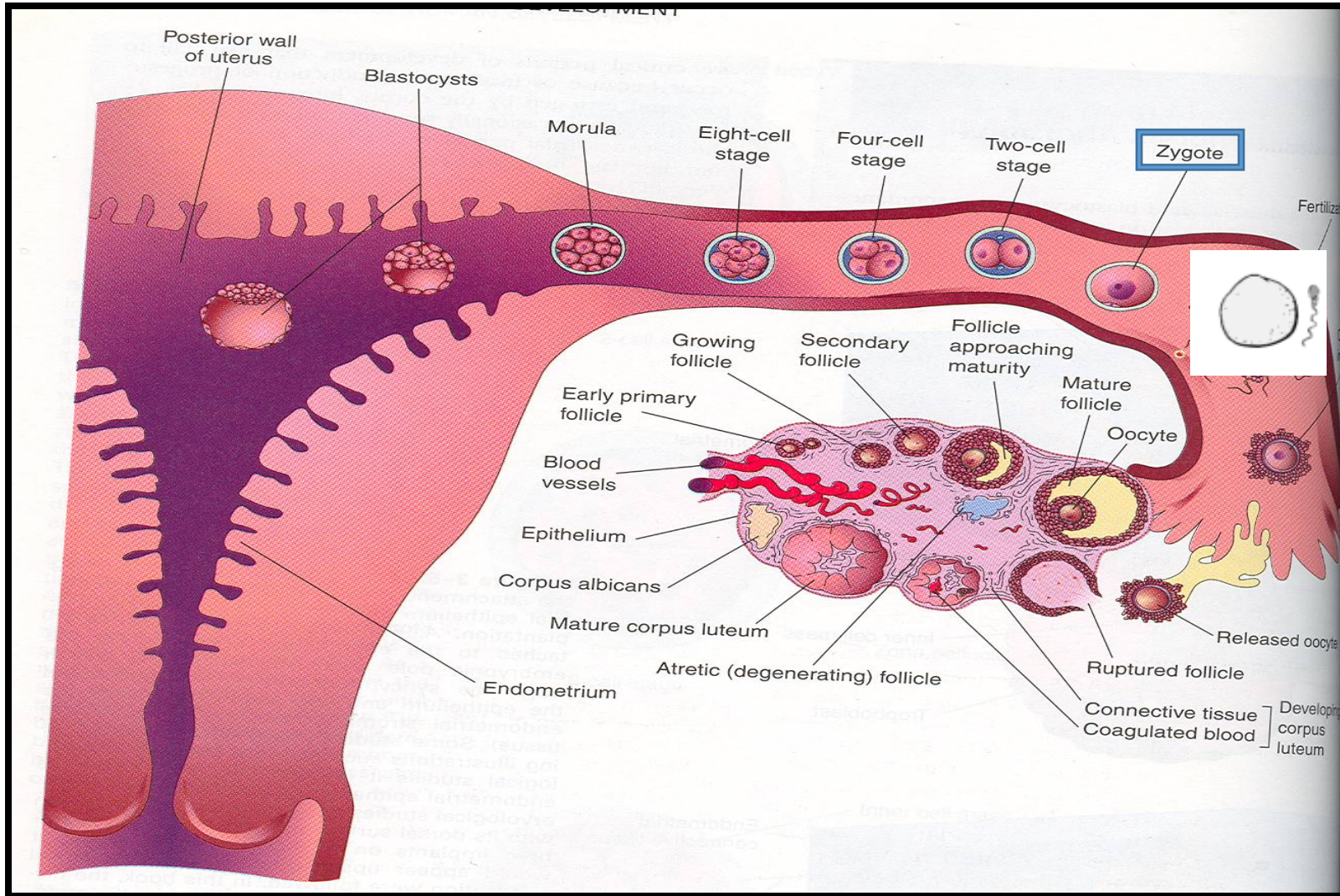
- 1- Reduction of chromosomal number from the diploid to the **haploid number**.
- 2- Change the primitive germ cell (spermatogonia) to the **motile sperm**.
- 3- Increase the number of the sperms.

OOGENESIS

- **It is the process** of formation of mature ovum,
- **It occurs** in the cortex of the ovary,
- **starts;** during fetal life, continues after puberty, and fertilization, till menopause.
- **It ends** by haploid number of chromosomes.



FERTILIZATION



- **Definition:**
- It is the process during which a mature male gamete (**sperm**) unites with a female gamete (**oocyte**) to form a single cell (**ZYGOTE**).
- **Site :** It occurs in the uterine tube.
- **Results of fertilization:**
- The diploid number of chromosomes is restored,
- The sex of the embryo is determined,
- **Initiates cleavage** (cell division) **of the zygote**

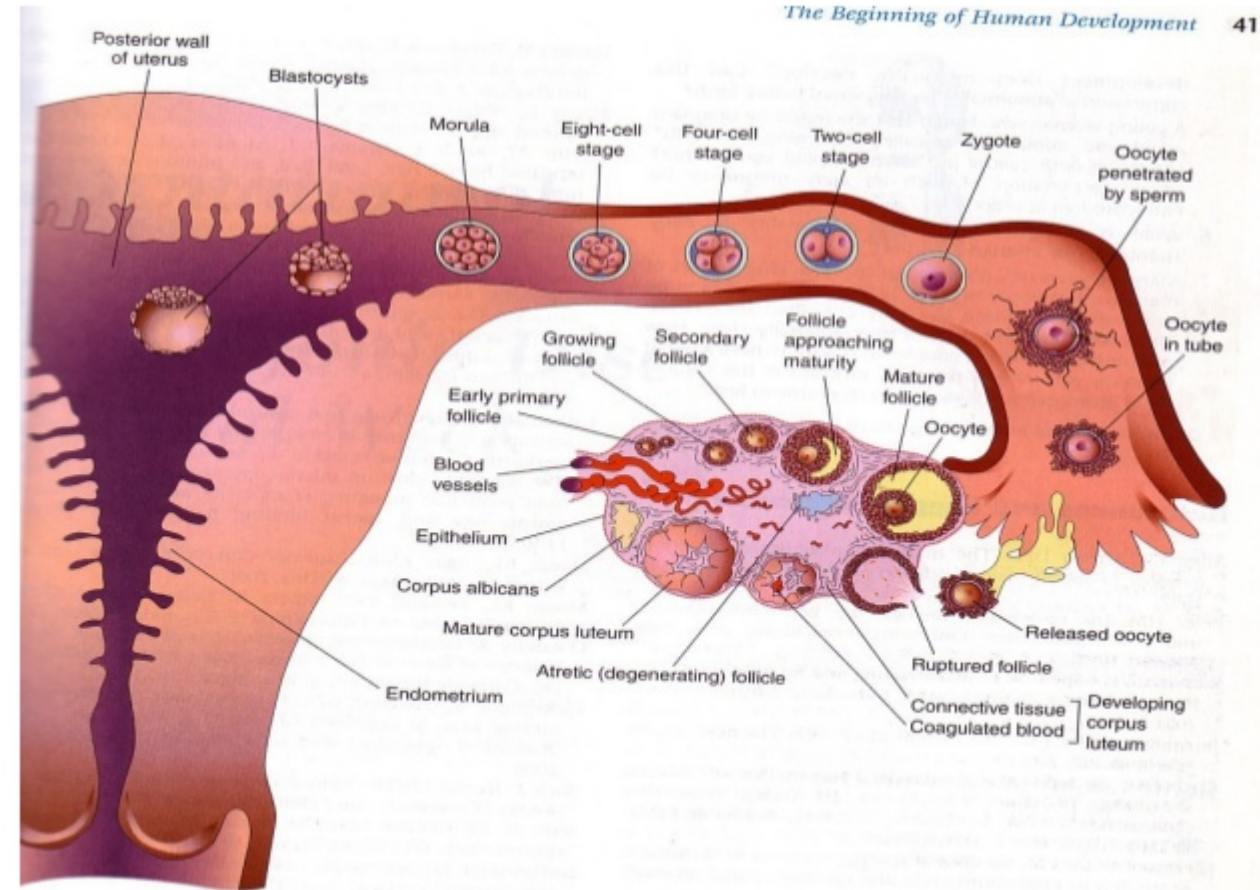
IMPLANTATION

- 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.
- Normal site of implantation :

In the **upper part** of the **posterior surface** of the **uterus** near the **fundus**.

Abnormal site of implantation (ectopic pregnancy) :

Most of ectopic pregnancies occurs in the **uterine tube**



BILAMINAR DISC

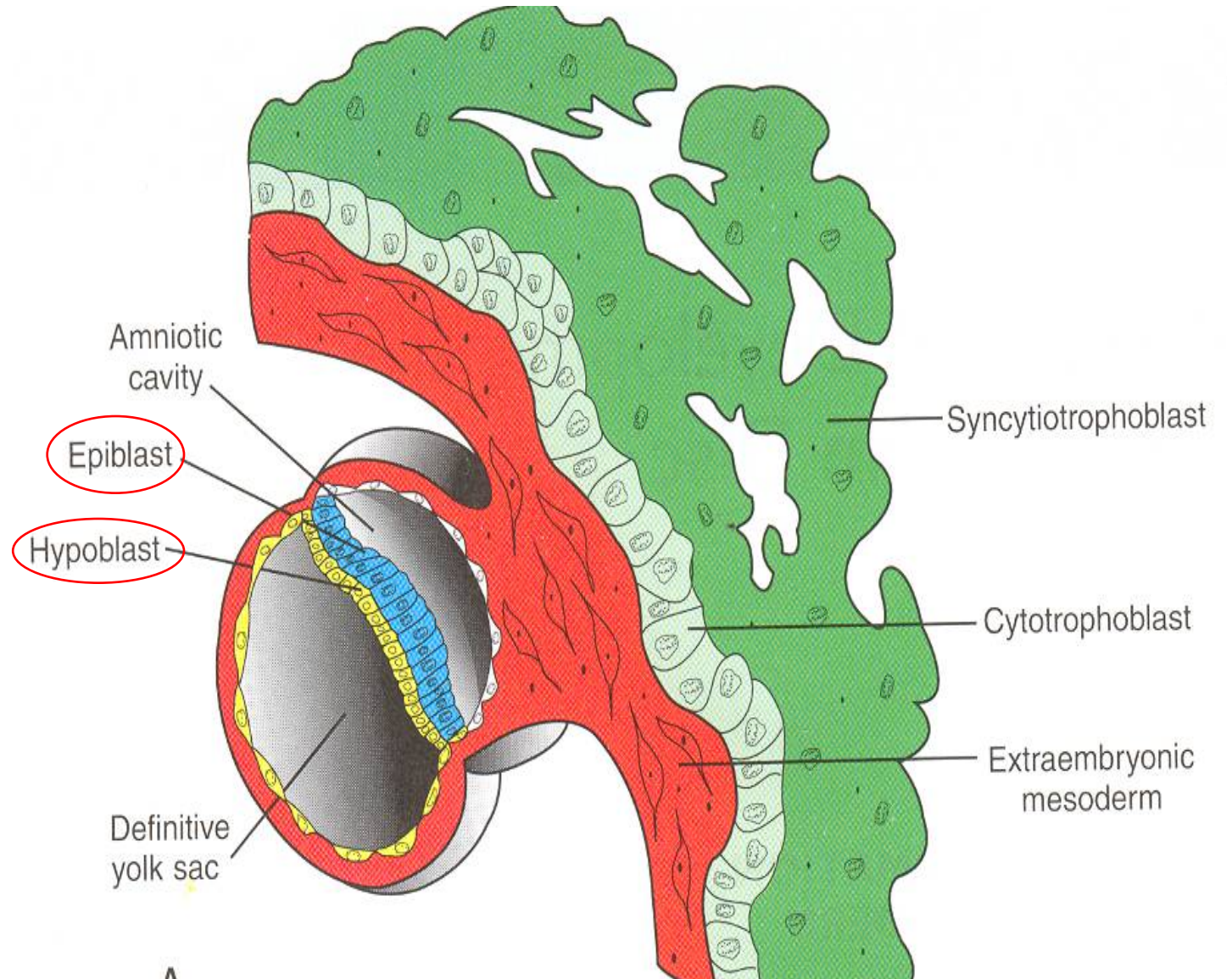
It is The differentiation of the cells into Two layers :

(A) Epiblast

High columnar cells adjacent to the amniotic cavity.

(B) Hypoblast

Small cuboidal cells adjacent to Yolk sac.

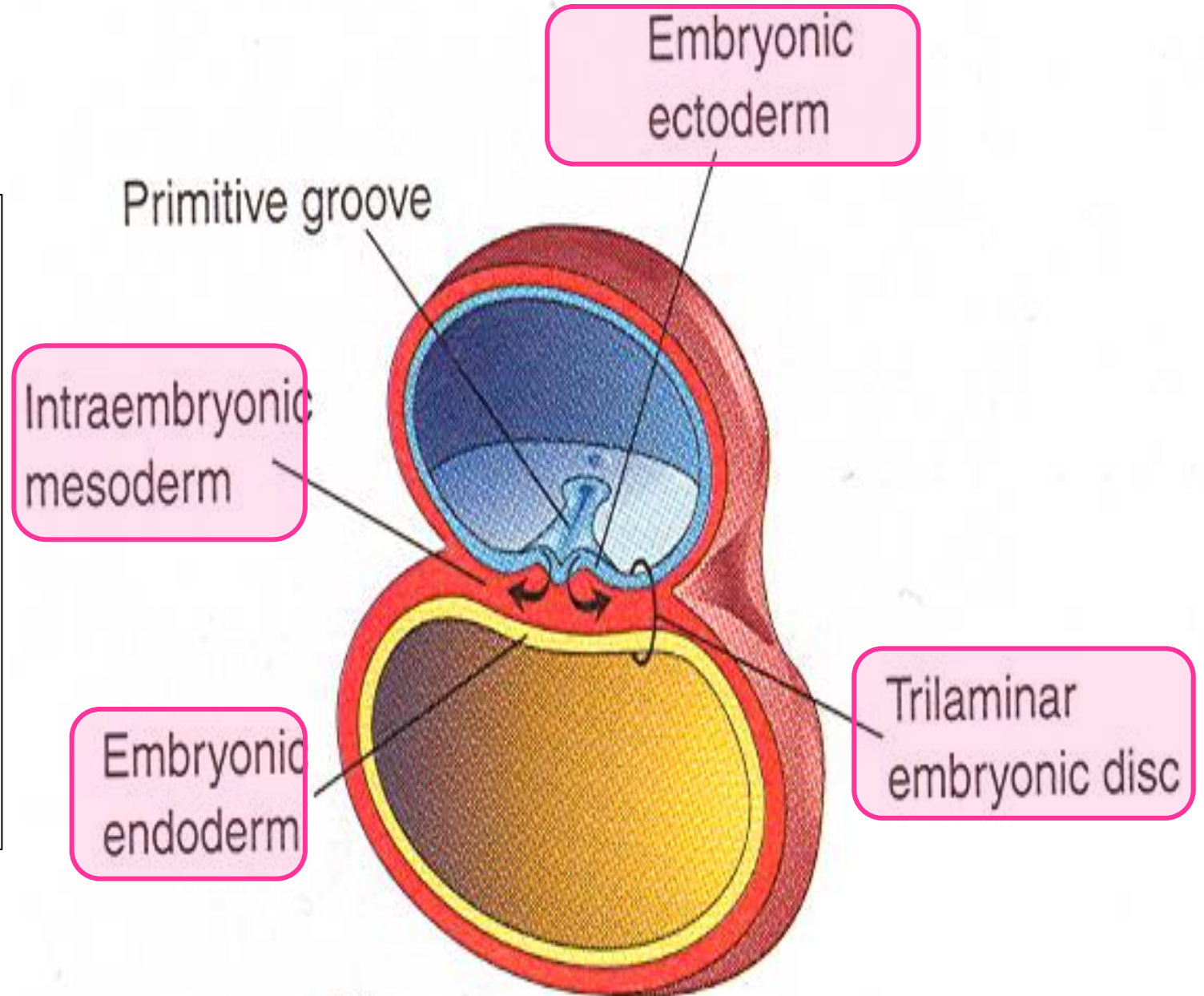


TRILAMINAR DISC

Now the embryonic disc is formed of 3 layers :

- ***Embryonic Ectoderm***
- ***Intraembryonic Mesoderm.***
- ***Embryonic Endoderm.***

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



Reference

- MOORE PERSAUD “ THE DEVELOPING HUMAN” Clinically Oriented Embryology. 7th edition

Thank you