Embryology Lect.3 د. عذراء 2023

Second Week of Development

During this menstrual cycle, the uterine endometrium passes through three stages, the **follicular** or **proliferative phase,** the **secretory** or **progestational phase,** and the **menstrual phase**

If fertilization does occur, the endometrium assists in implantation and contributes to formation of the placenta.

At the time of implantation, the mucosa of the uterus is in the secretory phase ,during which time uterine glands and arteries become coiled and the tissue becomes succulent. **Implantation occurs at the end of the first week. Trophoblast cells invade the epithelium and underlying endometrial stroma with the help of proteolytic enzymes.**

Bilaminar Germ Disc

At the beginning of the second week, the blastocyst is partially embedded in the endometrial stroma. The **trophoblast** differentiates into (*a*) an inner, actively proliferating layer, the **cytotrophoblast,** and (*b*) an outer layer, the **syncytiotrophoblast,** which erodes maternal tissues .

By day 9, lacunae develop in the syncytiotrophoblast. Subsequently, maternal sinusoids are eroded by the syncytiotrophoblast, maternal blood enters the lacunar network, and **by the end of the second week, a primitive uteroplacental circulation** begins. The cytotrophoblast, meanwhile, forms cellular columns called **primary villi. By the end of the second week, the blastocyst is completely embedded**.

The second week of development is known as the week of twos because of:

1.trophoblast differentiates into two layers, the cytotrophoblast and syncytiotrophoblast.

2.The embryoblast forms two layers, the epiblast and hypoblast.

3.Two cavities formed amnion cavity and yolk sac cavity.

Implantation may also occur outside the uterus, such as in the rectouterine pouch, on the mesentery, in the uterine tube, or in the ovary (**ectopic pregnancies**).

Third Week of Development:

Trilaminar Germ Disc

The most characteristic event occurring during the third week of gestation is **gastrulation, the process that establishes all three germ layers (ectoderm, mesoderm,** and **endoderm)** in the embryo.

Gastrulation begins with formation of the primitive streak on the surface of the epiblast. Initially, the streak is vaguely defined ,but in a 15- to 16-day embryo, it is clearly visible **as a narrow groove with slightly bulging regions on either side** .

Cells of the **epiblast migrate** toward the primitive streak .Then inward movement is known as **invagination.** Once the cells have invaginated, some **displace the hypoblast**, creating the embryonic **endoderm,** and others come to lie **between the epiblast and newly created endoderm** to form **mesoderm. Cells remaining in the epiblast** then form **ectoderm.**

Thus, the epiblast, through the process of gastrulation, is the source of all of the germ layers), and cells in these layers will give rise to all of the tissues and organs in the embryo. By the end of the third week, three basic **germ layers,** consisting of **ectoderm, mesoderm,** and **endoderm,** are established in a cephalocaudal direction as gastrulation continues.

Formation of the Notochord

cells of the notochordal plate proliferate and form a solid cord of cells, the **definitive notochord ,which underlies the neural tube and serves as the basis for the axial skeleton.**

C L I N I C A L C O R R E L A T E S

Teratogenesis Associated With Gastrulation

The beginning of the third week of development, when gastrulation is initiated, **is a highly sensitive stage for teratogenic insult**. At this time, fate maps can be made for various organ systems, such as the eyes and brain anlage, and these cell populations may be damaged by teratogens. For example, high doses of alcohol at this stage kill cells in the anterior midline of the germ disc, producing a deficiency of the midline in craniofacial structures and resulting Gastrulation itself may be disrupted by genetic abnormalities and toxic insults.

In (**caudal dysgenesis) :insufficient mesoderm is formed in the caudal-most region of the embryo. Because this mesoderm contributes to formation of the lower limbs, urogenital system (intermediate mesoderm), and lumbosacral vertebrae** abnormalities in these structures ensue. **Affected individuals exhibit** a variable range of defects, including **hypoplasia and fusion of the lower limbs, vertebral abnormalities, renal agenesis, imperforate anus, and anomalies of the genital organs .**

Sacrococcal (Teratoma): developed from remnants of primitive streak ,about 75% of affected infants are female.

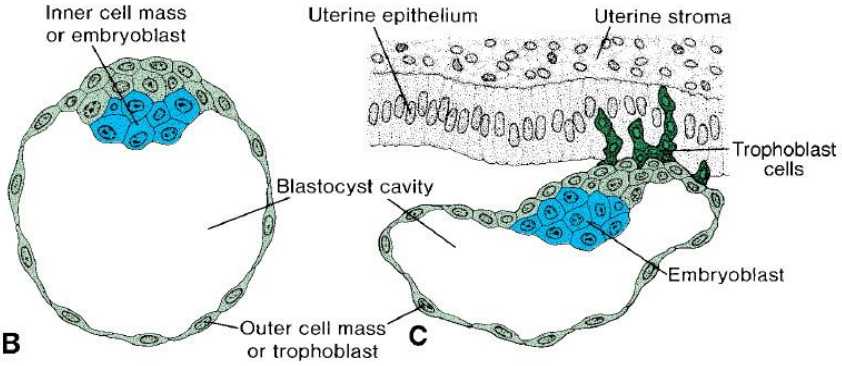
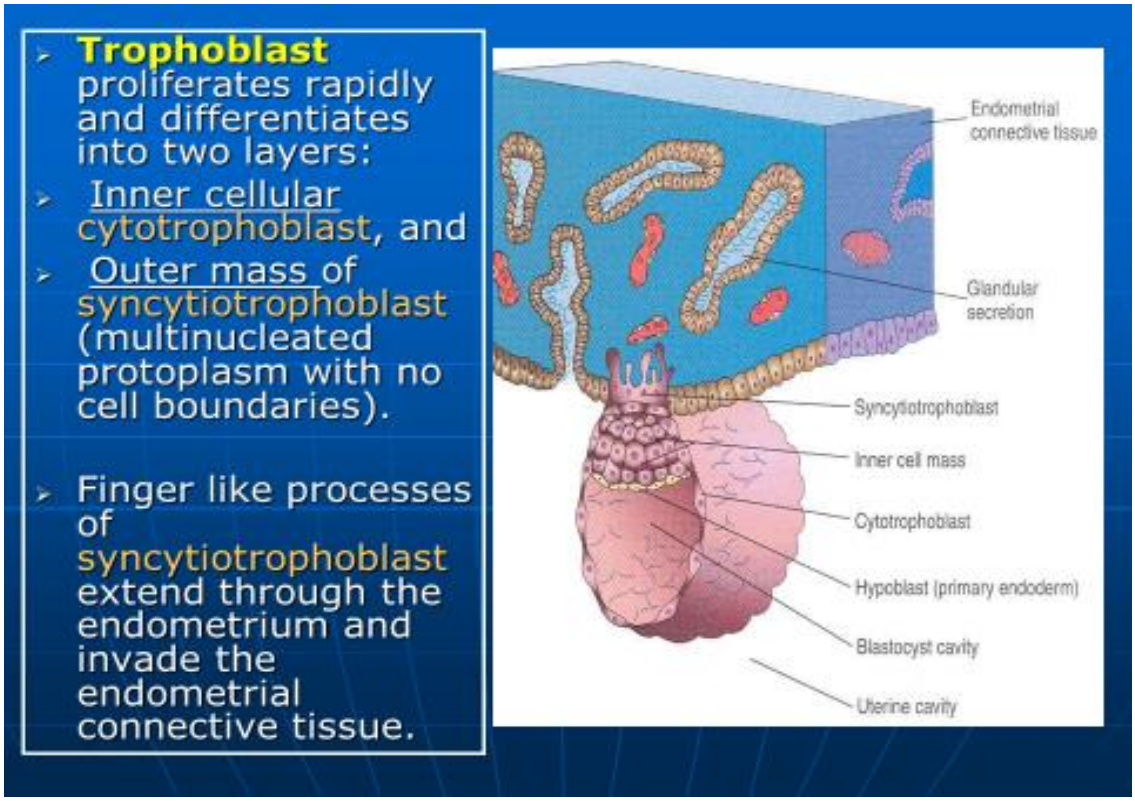
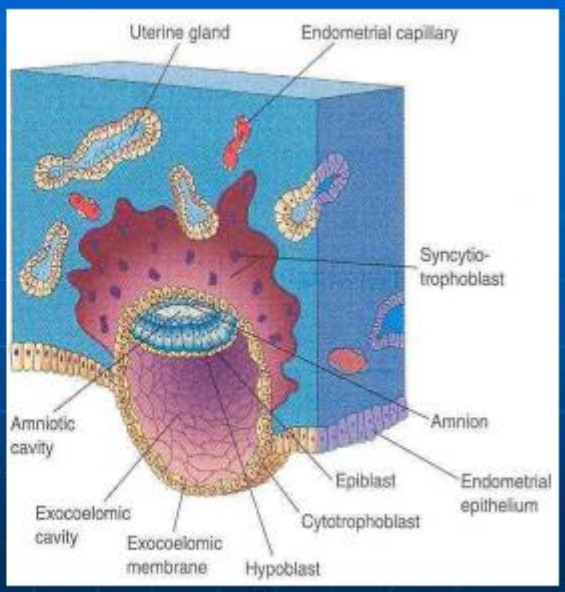


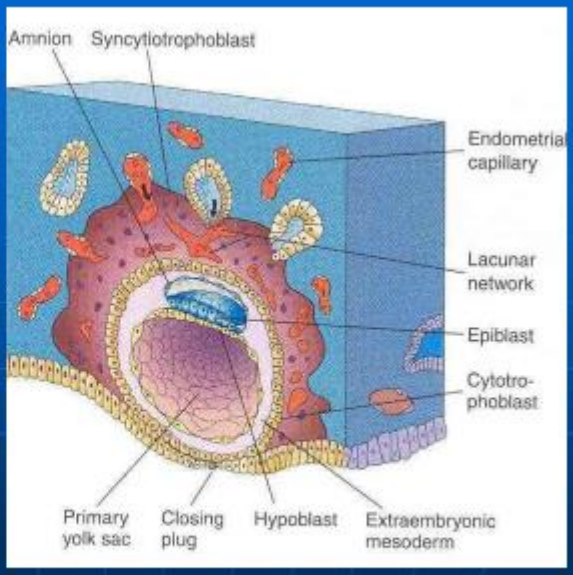
Figure 2.10 A. Section of a 107-cell human blastocyst showing inner cell mass and trophoblast cells. **B.** Schematic representation of a human blastocyst recovered from the uterine cavity at approximately 4.5 days. *Blue*, inner cell mass or embryoblast; *green*, trophoblast. **C.** Schematic representation of a blastocyst at the ninth day of development showing trophoblast cells at the embryonic pole of the blastocyst penetrating the uterine mucosa. The human blastocyst begins to penetrate the uterine mucosa by the sixth day of development.

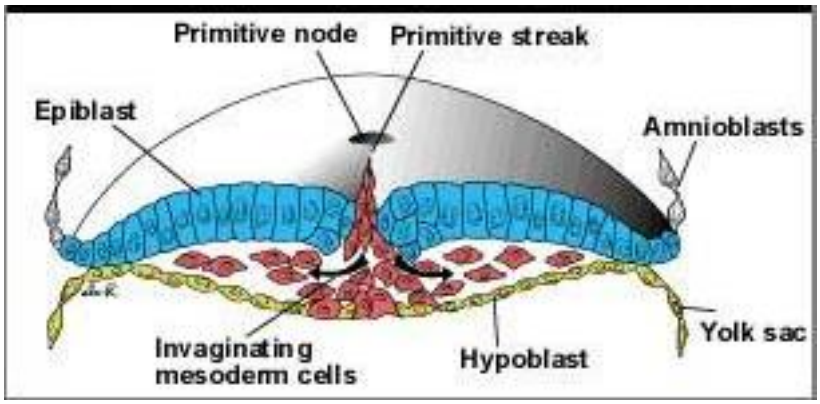


- By the end of 7th day, the blastocyst gets implanted in the superficial compact layer of the endometrium and derives its nourishment from the eroded endometrium.



- The blastocyst gradually embed deeper in the endometrium and the defect in the endometrial epithelium is filled by closing plug **(day 10).**





Caudal dysgenesis

Teratoma developed from remnant of primitive streak