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ASSIGNMENT

DISCUSS SECOND WEEK OF EMBRYONIC DEVELOPMENT

## 2nd week of embryonic development

During the 2nd week of development special event takes place:

1. Completion of implantation of blastocyst
2. Formation of bilaminar germ disc
3. Formation of extra embryonic structures

I. Introduction: on day 7, endometrial invasion has begun, and the trophoblast differentiates into 2 layers: a cytotrophoblast and a syncytiotrophoblast or syncytium. The active erosive trophoblast invades the endometrial stroma containing capillaries and glands, and the blastocyst slowly sinks into the endometrium. The syncytium at the embryonic pole, near the developing embryo, rapidly becomes a thick, multinucleated protoplasmic mass with no cell boundaries. It is invasive, ingestive, and digestive, and the conceptus derives its initial nourishment from endometrial tissues. Later it receives nutrients directly from maternal blood. The cytotrophoblast is mitotically active and forms new cells that migrate into the increasing mass of the syncytiotrophoblast.

II. In week 2 of implantation, the trophoblast penetrates deeper into the endometrium, and the blastocyst changes morphologically. The inner cell mass produces a bilaminar

embryonic disk composed of epiblast (future embryonic ectoderm and mesoderm) and embryonic endoderm. Concomitantly, the amniotic cavity, yolk sac, connecting stalk, and chorion develop.

III. Normal stages of week 2 development

A. DAY 8

1. Cells of the inner cell mass differentiate into 2 distinct layers
    a. Endodermal (entodermal) germ layer: layer of small, cuboidal cells
    b. Ectodermal germ layer: layer of high columnar cells
2. The cells of each germ layer form a flat disk and together are known as the *bilaminar germ disk*
3. Cells of the ectodermal layers, initially firmly attached to the cytotrophoblast, develop small clefts between their layers as development proceeds
    a. The clefts coalesce and form a cavity, the amniotic cavity
    b. Amnioblasts, large, flattened cells, are seen along the trophoblastic border of the newly formed amniotic cavity (probably derived from trophoblast)
        i. The cells are continuous with the ectoderm and together line the *amniotic cavity*
    c. Endometrial stroma adjacent to the implantation site is edematous, highly vascular, with large tortuous glands that secrete glycogen and mucus

B. DAY 9: blastocyst embeds deeper into endometrium, and a fibrin coagulum "plug" (blood clot and cellular debris) closes the penetration defect in uterine epithelial surface - *interstitial implantation*

1. Trophoblast progresses in development, especially at the embryonic pole, and vacuoles appear in the syncytium. The vacuoles fuse to form large lacunae (lakes), and we have the lacunar stage of trophoblast development
2. Endometrial stroma around the trophoblast has vascular congestion, and the cells are rich in glycogen

3. Flattened cells delaminate from the inner surface of the cytotrophoblast, at the abembryonic pole, and form a thin membrane called *Heuser's exocoelomic membrane* which is continuous with the edges of the entodermal layer. Together, they form the lining of the *exocoelomic cavity* or the *primitive yolk sac*

C. *Embryos of the same fertilization size do not necessarily develop at the same rate. Considerable differences are seen in early developmental stages.

A. DAYS 10, 11, AND 12

1. The blastocyst becomes completely embedded in the endometrial stroma, and the uterine surface epithelium almost entirely covers the original epithelial lining defect of the mucos Only a slight protrusion is seen in the uterine lumen
2. The trophoblast is characterized by lacunar spaces in the syncytium, and they form an interconnecting network, particularly at the embryonic pole
3. At the abembryonic pole, the trophoblast consists of cytotrophoblastic cells and only a few lacunar spaces
4. The syncytial cells penetrate deep into the stroma and erode the endothelial lining of maternal congested and dilated capillaries called *sinusoids*
    a. The syncytium becomes continuous with the endothelial cells of the vessels, and maternal blood enters the lacunar system
    b. With more and more sinusoid invasion by the trophoblast, the lacunae eventually become continuous with the arterial and venous systems. Pressure differences between arterial and venous capillaries result in maternal blood flowing through the trophoblastic lacunar system to form the *uteroplacental circulation*
5. Cytotrophoblast also differentiates. On its inner surface, cells delaminate to form a fine, loose tissue, the *extraembryonic mesoderm*, which fills the space between external trophoblast and amnion and internal yolk sac
    a. Large cavities develop in this extraembryonic mesoderm, become confluent, and form the *extraembryonic coelom*, which surrounds the primitive yolk sac and amniotic cavity, except where the extraembryonic mesoderm forms the future connection between the germ disk and the trophoblast
        i. The extraembryonic mesoderm lining the cytotrophoblast and amnion is called the *extraembryonic somatopleuric mesoderm*; that covering the yolk sac is called the *extraembryonic splanchnopleuric mesoderm*

6. The bilaminar germ disk grows slowly compared to the trophoblast, but by the end of day 12, entodermal cells begin to spread over the inside of Heuser's membrane
7. Endometrial cells become polyhedral, are loaded with glycogen and lipids, and the intercellular spaces fill with extravasate; the tissue is edematous - all a process of the *decidual reaction*, initially at implantation site but then throughout endometrium

B. DAYS 13 AND 14: the endometrial surface defect is usually healed, but there may be occasional bleeding at the site of implantation due to the increased blood flow in the lacunar spaces at the abembryonic pole. Can be confused with menstrual bleeding
   1. The trophoblast shows more organization at the embryonic pole
   2. The cytotrophoblast cells proliferate, penetrate the syncytium, and form cellular columns surrounded by syncytium-together forming the *primary stem villi*
   3. The entodermal germ layer proliferates and newly formed cells gradually line a new cavity known as the *secondary or definitive yolk sac* (smaller than original)
   4. The extraembryonic coelom expands to form the *chorionic cavity*
   5. The extraembryonic mesoderm then lines the cytotrophoblast and is called the *chorionic plate*. It also forms a covering layer for the secondary yolk sac and amnion
      a. The extraembryonic mesoderm only traverses the chorionic cavity in the connecting stalk (connecting the embryo with the trophoblast)
         i. With development of blood vessels, the stalk becomes the *umbilical cord*
   6. By the end of week 2, the germ disk consists of two apposed cell disks: the ectodermal germ layer, forming the floor of the expanding amniotic cavity, and the entodermal germ layer, forming the roof of the secondary yolk sac
      a. In its cephalic region, the entodermal disk is thickened to form the *prochordal plate*, an area of columnar cells attached to the overlying ectodermal disk
   7. The primitive streak appears and indicates the onset of gastrulation