

18/MHS01/074

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EMBRYOLOGY

MBBS

200 LEVEL

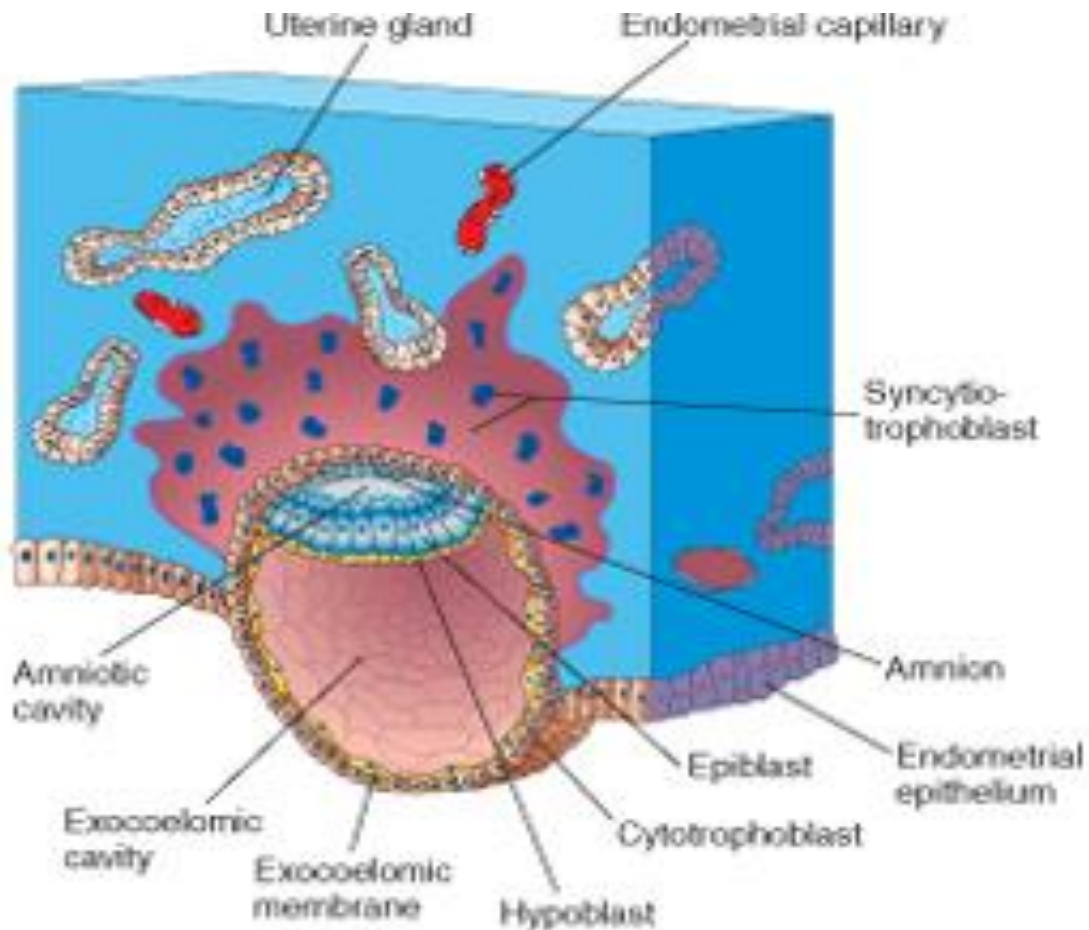
2ND WEEK OF DEVELOPMENT

The second week of human development is concerned with the process of and the differentiation of the blastocyst into early embryonic and placental forming structures.

- implantation commences about **day 6 to 7**
- **Adplantation** - begins with initial adhesion to the uterine epithelium
- blastocyst then slows in motility, "rolls" on surface, aligns with the inner cell mass closest to the epithelium and stops
- **Implantation** - migration of the blastocyst into the uterine epithelium, process complete by about **day 9**
- **coagulation plug** - left where the blastocyst has entered the uterine wall **day 12**

Normal Implantation Sites - in uterine wall superior, posterior, lateral

Uterus



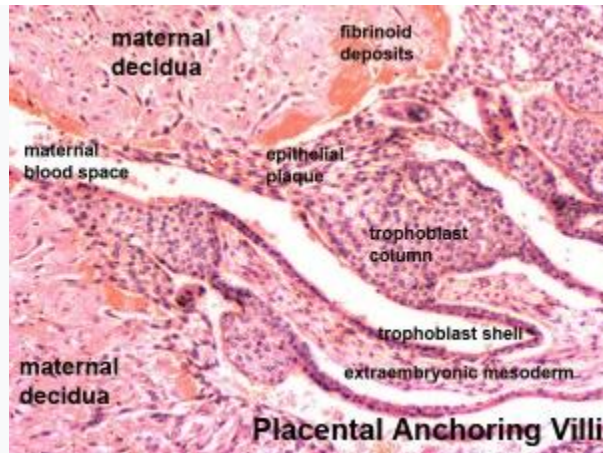
Uterine gland secretory phase

- Endometrium - 3 layers in secretory phase of menstrual cycle: compact, spongy, basal
- Myometrium - muscular layer outside endometrium, contracts in parturition
- Perimetrium - tunica serosa of the uterus continuous with the peritoneal wall

Endometrial Layers

- Compact - implantation occurs in this layer, dense stromal cells, uterine gland necks, capillaries of spiral arteries
- Spongy - swollen stromal cells, uterine gland bodies, spiral arteries
- Basal - not lost during menstruation or childbirth, own blood supply

Decidual Reaction



Decidual Reaction

- occurs initially at site of implantation and includes both cellular and matrix changes
- reaction spreads throughout entire uterus, not at cervix
- deposition of fibrinoid and glycogen and epithelial plaque formation (at anchoring villi)
- presence of decidual cells are indicative of pregnancy

Cervix - at mouth of uterus, secretes mucus (CMP), forms a plug/barrier, mechanical and antibacterial
 Vascular - increased number of blood vessels

Decidua

The endometrium becomes the decidua and forms 3 distinct anatomical regions (at approx 3 weeks)

- Decidua Basalis at implantation site
- Decidua Capsularis enclosing the conceptus
- Decidua Parietalis the remainder of uterus
- Decidua Capsularis and Parietalis fuse eventually fuse and uterine cavity is lost by 12 weeks

Bilaminar Embryo

- Human development about **day 8 to 9**

The embryoblast (inner cell mass) forms the epiblast and hypoblast layers. This early stage of embryo development is referred to as the bilaminar embryo.

The inner cell mass forms an inner layer of larger cells is also called the "embryoblast" is a cluster of cells located and attached on one wall of the outer trophoblast layer. In week 2 this mass will differentiate into two distinct layers the epiblast and hypoblast, also called the bilaminar embryo.

Epiblast

The epiblast layer will form the entire embryo and undergoes gastrulation in week three to form the 3 germ layers. It also forms an epithelial layer lining the amniotic cavity.

Hypoblast

The hypoblast (or primitive endoderm) is a transient epithelial layer facing towards the blastocoel, it is replaced in week three by the gastrulation migrating endoderm cells.

Syncytiotrophoblasts

- secrete proteolytic enzymes, enzymes break down extracellular matrix around cells
- Allow passage of blastocyst into endometrial wall, totally surround the blastocyst
- generate spaces that fill with maternal blood- lacunae
- Secrete Human Chorionic Gonadotropin (hCG), hormone, maintains decidua and corpus luteum. This hormone is diagnostically the basis of pregnancy tests, and is present in maternal.
- Later in development placenta will secrete hCG

Human Chorionic Gonadotropin

(hCG) Placental hormone initially secreted by cells (syncytiotrophoblasts) from the implanting conceptus during week two, supporting the ovarian corpus luteum, which in turn supports the endometrial lining and therefore maintains pregnancy.^[1] Hormone can be detected in maternal blood and urine and is the basis of many pregnancy tests. Hormone also stimulates the onset of fetal gonadal steroidogenesis, high levels are teratogenic to fetal gonadal tissues. Other potential cellular sources can include: hyperglycosylated hCG produced by cytotrophoblast cells, free beta-subunit made by multiple primary non-trophoblastic malignancies, and pituitary hCG made by the gonadotrope cells of the anterior pituitary.

- The molecular weight of hCG is approximately 36,000 (36 KDa) for the α -subunit and a β -subunit that are held together by both non-covalent hydrophobic and ionic interactions.

Human Levels

- levels peak at 8 to 10 weeks of pregnancy, then decline and are lower for rest of pregnancy
 - 0-1 week: 0-50 mIU/ml ^[1]_{SEP}
 - 1-2 weeks: 40-300 mIU/ml
 - 3-4 weeks: 500-6,000 mIU/ml
 - 1-2 months: 5,000-200,000 mIU/ml
 - 2-3 months: 10,000-100,000 mIU/ml
 - 2nd trimester: 3,000-50,000 mIU/ml

3rd trimester: 1,000-50,000 mIU/ml

Non-pregnant females: <5.0 mIU/ml Postmenopausal females: <9.5 mIU/ml

Functions

1. Promotion of corpus luteal progesterone production
2. Angiogenesis of uterine vasculature
3. Cytotrophoblast differentiation
4. Immuno-suppression and blockage of phagocytosis of invading trophoblast cells
5. Growth of uterus in line with fetal growth
6. Quiescence of uterine muscle contraction
7. Promotion of growth and differentiation of fetal organs
8. Umbilical cord growth and development
9. Blastocysts signals endometrium prior to implantation
10. hCG in sperm and receptors found in fallopian tubes suggesting pre-pregnancy communication
11. hCG receptors in adult brain hippocampus, hypothalamus and brain stem, may cause pregnancy nausea and vomiting
12. hCG and implantation of pregnancy, hCG stimulates metalloproteinases of cytotrophoblast cell