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Second stage of embryological development

When implantation succeeds and the blastocyst adheres to the endometrium, the superficial cells of the trophoblast fuse with each other, forming the syncytiotrophoblast, a multinucleated body that digests endometrial cells to firmly secure the blastocyst to the uterine wall. In response, the uterine mucosa rebuilds itself and envelops the blastocyst. The trophoblast secretes human chorionic gonadotropin (hCG), a hormone that directs the corpus luteum to survive, enlarge, and continue producing progesterone and estrogen to suppress menses. These functions of hCG are necessary for creating an environment suitable for the developing embryo. As a result of this increased production, hCG accumulates in the maternal bloodstream and is excreted in the urine. Implantation is complete by the middle of the second week. Just a few days after implantation, the trophoblast has secreted enough hCG for an at-home urine pregnancy test to give a positive result.

Bilaminar Embryoblast

- about **day 8 to 9**
- The outer trophoblast and inner embryoblast layers now both differentiate to form two distinct cellular layers.
- The trophoblast layer forms the **syncitotrophoblast** and **cytotrophoblast** layers.
- The embryoblast (inner cell mass) forms the **epiblast** and **hypoblast** layers.
    - **Epiblast** - will form the 3 germ layers.
    - **Hypoblast** - transient layer replaced by endoderm.
- This early stage of embryo development is referred to as the **bilaminar embryo**.

Bilaminar Trophoblast

Two trophoblast layers Cytotrophoblast and Syncitotrophoblast.

Cytotrophoblasts - form a continuous cellular layer that covers the developing placental villi.

Syncitotrophoblast

- **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, basis of pregnancy diagnostic test, present in urine is diagnostic of pregnancy
    - levels peak at 8 to 10 weeks of pregnancy, then decline and are lower for rest of pregnancy
    - Later in development placenta will secrete hCG

Amniotic cavity

While implantation ensues, the embryoblast also undergoes differentiation to form a bilaminar disc. The flat, circular disc is comprised of a thicker epiblast with high columnar cells and a thinner hypoblast with small cuboidal cells. A small space develops relative to the epiblast; it is the precursor of the amniotic cavity.

Epiblastic cells forming the floor of the cavity subsequently separate to form amnioblasts that will form the amnion (surrounding the amniotic cavity). The sac and cavity will eventually become filled with amniotic fluid later on in the pregnancy. They provide shock a

bsorption and facilitate movement of the foetus during development.

While the aforementioned cavities and bilaminar disc develop, the syncytiotrophoblast began to lacunae (I.e. form lacunae). The lacunae are filled with an amalgam of cellular debris and maternal blood, known as the embryotroph. This fluid gains access to the embryonic disc via diffusion and delivers nutrients as well as oxygen to the embryo. The lacunae subsequently become confluent, forming lacunar networks, which serves as the primordial uteroplacental circulation. As the networks continue to fuse, the syncytiotrophoblast has a sieve-like appearance, particularly around the embryonic pole of the conceptus. This will subsequently give rise to the intervillous spaces of the placenta.

The capillaries around the implanted embryo become engorged, dilated and their walls become thin. From here onwards, they are known as sinusoids. The syncytiotrophoblast continues to erode the walls of the sinusoids, resulting in more maternal blood flowing freely into the lacunar networks. Much of the derived nutrients is conveyed to the embryo by the trophoblast. However, the trophoblast grows a lot faster than the embryo in the early phases. As such, it is likely to have a higher nutritional requirement than the embryo.

Chorionic sac

As time progresses, the extraembryonic mesoderm increases in size. Numerous cavities known as the extraembryonic coelomic spaces begin to appear deep to the cytotrophoblast and superficial to the exocoelomic membrane. These spaces coalesce to form the extraembryonic coelom. This coincides with a decrease in the volume of the primary umbilical vesicle; which is then referred to as the secondary umbilical vesicle. The cells of the secondary umbilical vesicle arise from migratory extraembryonic endodermal cells of the hypoblast. There is a remnant of the primary umbilical vesicle within the extraembryonic coelom that is referred to as an exocoelomic cyst.

cellular columns, lined with syncytial coverings, extending into the syncytiotrophoblast indicate the ending of the second gestational week. This phenomenon marks the formation of the primary chorionic villi. Splanchnic and somatic derivatives of the extraembryonic mesoderm line the umbilical vesicles, and the trophoblast and amnion, respectively. The somatic extraembryonic mesoderm, along with both trophoblastic layers, gives rise to the chorion. The space enclosed by the chorion is the chorionic sac; it contains the embryo, as well as the amniotic sac and umbilical vesicle. The latter three structures are attached to the chorion by the connecting stalk. The former extraembryonic coelom is now referred to as the chorionic cavity.

By the 10th day following fertilization, the embryo is completely embedded in the endometrium. There is a small defect in the epithelium that is sealed by a fibrin-based blood clot known as the closing plug. By day 12, the area is completely healed. The 14-day embryo maintains the form of a flat bilaminar embryonic disc at the end of second week. The thickened prechordal plate develops as a localized thickening of hypoblast and indicates the future site of mouth and organizer of the head region.