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SECOND WEEK OF DEVELOPMENT

The second week of human development is concerned with the process of completion of blastocyst implantation, the formation of the bilaminar germ disc and the formation of extra - embryonic structures.

At the end of the first week, the blastocyst comes in contact with the uterine wall and adheres to it, embedding itself in the uterine lining via the trophoblast cells. Thus begins the process of **implantation**, which signals the end of the pre-embryonic stage of development. Implantation can be accompanied by minor bleeding. The blastocyst typically implants in the fundus of the uterus or on the posterior wall. However, if the endometrium is not fully developed and ready to receive the blastocyst, the blastocyst will detach and find a better spot.

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.

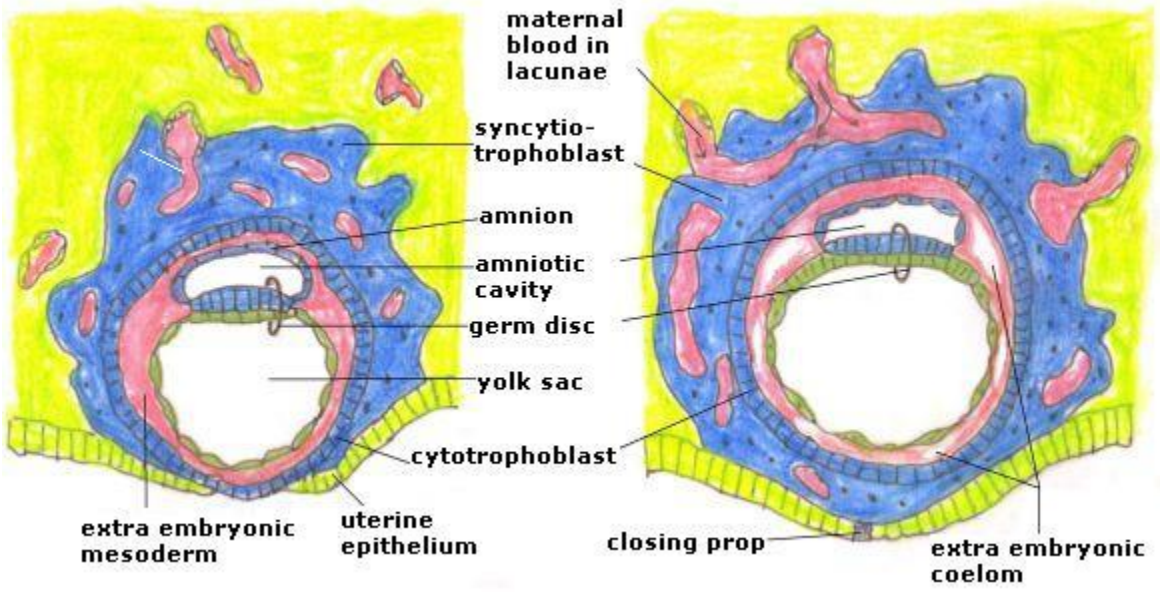
EXTRA UTERINE PREGNANCY

Most of the time an embryo implants within the body of the uterus in a location that can support growth and development. However, in one to two percent of cases, the embryo implants either outside the uterus (an **ectopic pregnancy**) or in a region of uterus that can create complications for the pregnancy.

During the second week of development, with the embryo implanted in the uterus, cells within the blastocyst start to organize into layers. Some grow to form the extra-embryonic membranes needed to support and protect the growing embryo: the amnion, the yolk sac, the allantois, and the chorion.

On the eighth of the second week, the cells of the inner cell mass form into a two-layered disc of embryonic cells, and a space—the **amniotic cavity**—opens up between it and the trophoblast. Cells from the upper layer of the disc (the **epiblast**) extend around the amniotic cavity, creating a membranous sac that forms into the **amnion** by the end of the second week. The amnion fills with amniotic fluid and eventually grows to surround the embryo.

On the ventral side of the embryonic disc, opposite the amnion, cells in the lower layer of the embryonic disk the **hypoblast** extend into the blastocyst cavity and form a **yolk sac**. The yolk sac supplies some nutrients absorbed from the trophoblast and also provides primitive blood circulation to the developing embryo for the second and third week of development.



The hypoblast and epiblast layers **together** form a flat ovoid shaped disc called the **bilaminar embryonic disc**. At the same time, a small cavity appears within the epiblast which enlarges to form the amniotic cavity. Epiblast cells adjacent to the cytotrophoblast are called **amnioblasts**, **Amnioblasts** together with the rest of the epiblast, line the amniotic cavity. The endometrium adjacent to the implantation site is edematous and highly vascular.

On the ninth day, the blastocyst embeds deeply more in the endometrium, and the penetration defect in the surface epithelium is closed by a coagulum called **fibrin.** Vacuoles appear at the region of the trophoblast and they fuse to form lager lacunae this phase of trophoblast development is known as the **lacunar stage.**

The cells of the hypoblast adjacent to the cytotrophoblast form a thin membrane called the **exocoelomic (Heuser's) membrane** this membrane lines the inner surface of the cytotrophoblast the **exocoelomic (Heuser's) membrane** together with the hypoblast forms the lining of the **exocoelomic cavity,** or **primitive yolk sac** or **primary umbilical vesicle.**

The blastocyst is completely embedded in the endometrium, and the surface epithelium almost entirely covers the original defect in the uterine wall. The blastocyst now produces a slight protrusion into the lumen of the uterus cells of the syncytiotrophoblast penetrate deeper into the stroma(tissue) and erode the endothelial lining of the endometrial capillaries These ruptured endometrial capillaries are called **sinusoids.**

The lacunae will now begin to interact with the sinusoids, and maternal blood enters the lacunar system. The communication of the eroded endometrial capillaries with the lacunae establishes the **primordial uteroplacental circulation.** When maternal blood flows into the lacunae, oxygen and nutritive substances are available to the embryo a new population of cells appears between the inner surface of the cytotrophoblast and the outer surface of the exocoelomic cavity.

These cells which are derived from yolk sac cells form a fine, loose connective tissue called the **extraembryonic mesoderm**. Soon, large cavities develop in the extraembryonic mesoderm, and when these become confluent, they form a new space known as the **extraembryonic cavity,** or **chorionic cavity** or **extraembryonic coelom.** This space surrounds the primitive yolk sac and amniotic cavity, except where the germ disc is connected to the trophoblast by the connecting stalk (which develops into the umbilical cord).The extraembryonic mesoderm lining the cytotrophoblast and amnion is called the **extraembryonic somatic mesoderm, extraembryonic somatic mesoderm also forms the connecting stalk** the lining covering the yolk sac is known as the **extraembryonic splanchnic mesoderm.**

As the conceptus implants, the endometrial connective tissue cells undergo a transformation, called **decidual reaction.** During this transformation, the cells of the endometrium swell because of the accumulation of glycogen and lipid in their cytoplasm, and they are known as **decidual cells.** The primary function of the decidual reaction is to provide nutrition for the early embryo and an immunologically privileged site for the conceptus.

On 13th day of development, the surface defect in the endometrium will be completely covered by the surface epithelium. Occasionally bleeding occurs at the implantation site as a result of increased blood flow into the lacunar spaces. This marks the end of the second week of development.