Second week of development

Morula

During the first week the zygote undergoes cleavage divisions. When the cells number around sixteen the solid sphere of cells within the zona pellucida is referred to as a morula .
About the time the morula enters the uterine cavity, fluids begin to penetrate through the zona pellucida into the intercellular spaces of the inner cell mass. Gradually, the intercellular spaces become confluent, and finally, a single cavity, the blastocole foims.Cleavage continues as cellular differentiation, and then a blastocyst, consisting of embryoblast and trophoblast. At this time ZP disappears allowing implantation to occur.

Figure 3.8 Development of the zygote from the two-cell stage to the late morula stage. The two-cell stage is reached approximately 30 hours after fertilization; the four-cell stage is reached at approximately 40 hours; the 12- to 16-cell stage is reached at approximately 3 days; and the late morula stage is reached at approximately 4 days. During this period, blastomeres are surrounded by the zona pellucida, which disappears at the end of the fourth day.

Blastulation

The process of forming the blastocyst. Cells differentiate into an outer layer of cells called the trophoblast and an inner cell mass. The inner mass of cells differentiate to become embryoblasts and polarise at one end. They close together and form gap junctions, which facilitate cellular communication. This polarisation leaves a cavity, the blastocoel, creating a structure that is now termed the blastocyst.The resulting increase in size of the blastocyst causes it to hatch through the zone pellucida, which then disintegrates.

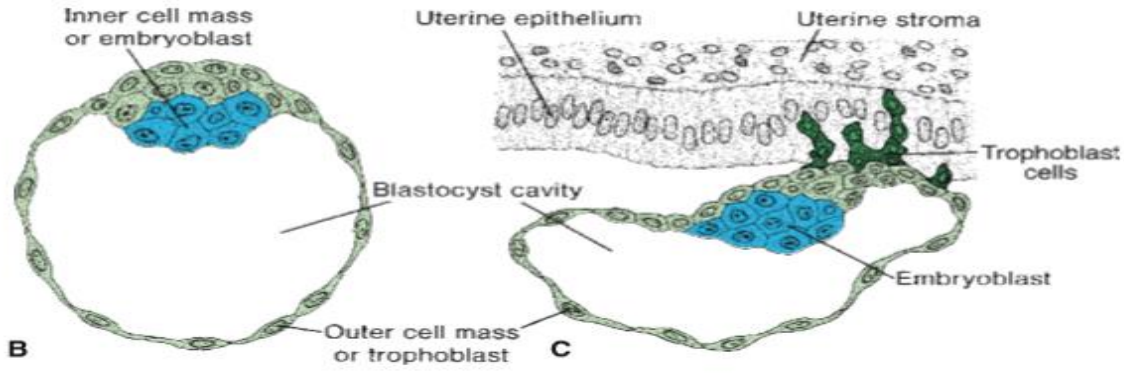

Figure 3.10 **A.** Section of a 107-cell human blastocyst showing inner cell mass and trophoblast cells. **B.** Schematic representation of a human blastocyst recovered from the uterine cavity at approximately 4.5 days. *Blue*, inner cell mass or embryoblast; *green*, trophoblast. **C.** Schematic representation of a blastocyst at the sixth 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.

The zona pellucida disappears completely, and exposed cells of the trophoblast allow the blastocyst to attach itself to the endometrium, where it will implant.

The formation of the hypoblast and epiblast, which are the two main layers of the bilaminar germ disc, occurs at the beginning of the second week.

The embryoblast and the trophoblast will turn into two sub-layers.

* The embryoblast forms **embryonic disc,** , which is **a** bilaminar disc of two layers,

1- an upper layer called **the epiblast** (primitive ectoderm) and

2- a lower layer called the **hypoblast (**primitive endoderm).

The disc is stretched between what will become the **amniotic cavity** and the **yolk sac.**

- At the eighth day of development, the blastocyst is partially embedded in the endometrial stroma. In the area over the embryoblast, the trophoblast has differentiated into two layers: (1) an inner layer of mononucleated cells, the cytotrophoblast,
- (2) an outer multinucleated zone without distinct cell boundaries, the syncytiotrophoblast.
- At the embryonic pole, flattened cells form a thin membrane, **the exocoelomic (Heuser) membrane** that lines the inner surface of the cytotrophoblast. This membrane, together with the hypoblast, forms the lining of the **exocoelomic cavity**, or primitive yolk sac.
- The syncytiotrophoblast will grow and will enter a phase called lacunar stage, in which some vacuoles will appear and be filled by blood in the following days.
- An erosion of the endothelial lining of the maternal capillaries by the syncytiotrophoblastic cells of the sinusoids will form where the blood will begin to penetrate and flow through the trophoblast to give rise to the uteroplacental circulation.
- **Implantation**: after ovulation, the endometrial lining becomes transformed into a secretory lining in preparation of accepting the embryo. It becomes thickened, with its secretory glands becoming elongated, and is increasingly vascular.
- The placenta develops once the blastocyst is implanted, connecting the embryo to the uterine wall.
- The syncytiotrophoblast also produces **human chorionic gonadotropin**, a hormone that stimulates the release of progesterone from the corpus luteum.
- Progesterone enriches the uterus with a thick lining of blood vessels and capillaries so that it can oxygenate and sustain the developing embryo. The embryo is joined to the trophoblastic shell by a narrow connecting stalk that develops into the umbilical cord to attach the placenta to the embryo.

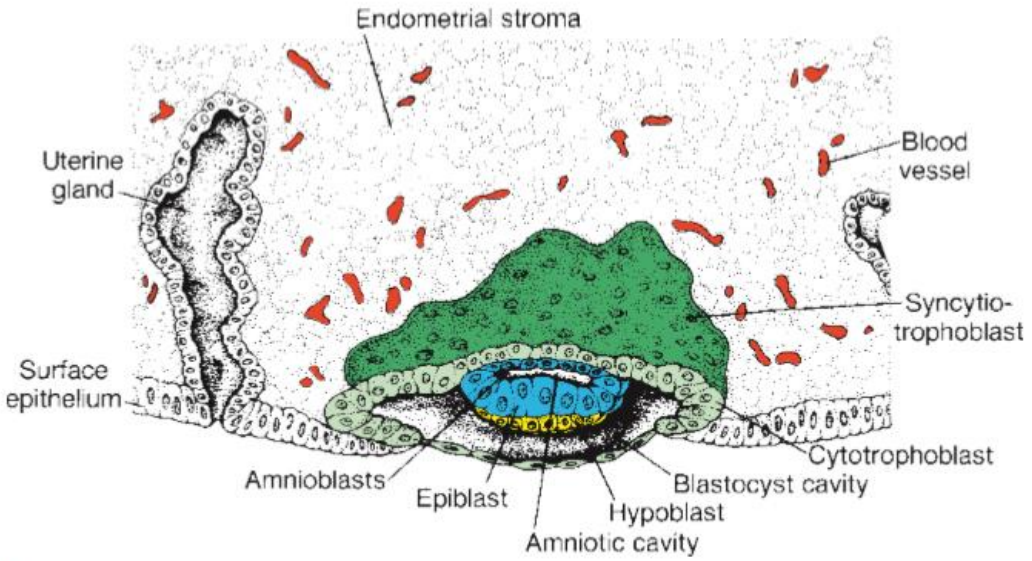

Figure 4.1 A 7.5-day human blastocyst, partially embedded in the endometrial stroma. The trophoblast consists of an inner layer with mononuclear cells, the cytotrophoblast, and an outer layer without distinct cell boundaries, the syncytiotrophoblast. The embryoblast is formed by the epiblast and hypoblast layers. The amniotic cavity appears as a small cleft.

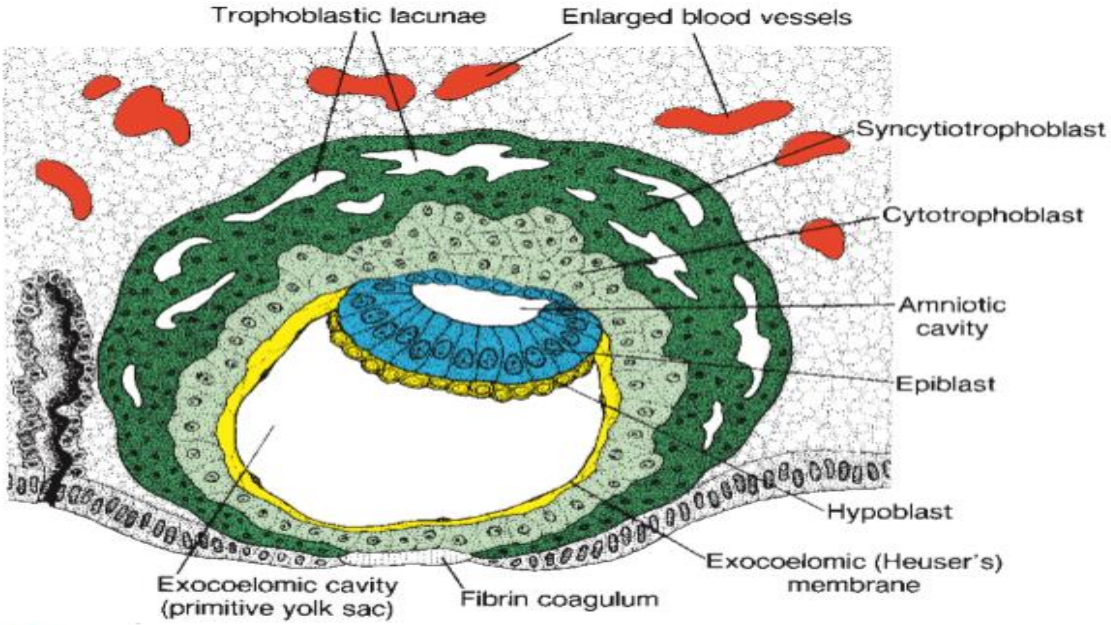

Figure 4.3 9-day human blastocyst. The syncytiotrophoblast shows a large number of lacunae. Flat cells form the exocoelomic membrane. The bilaminar disc consists of a layer of columnar epiblast cells and a layer of cuboidal hypoblast cells. The original surface defect is closed by a fibrin coagulum.

The second week of development is significant for:

1. the formation of the **bilaminar disc (two-layers)** — this will give rise to all the tissues and organs of the body
2. The completion, of implantation

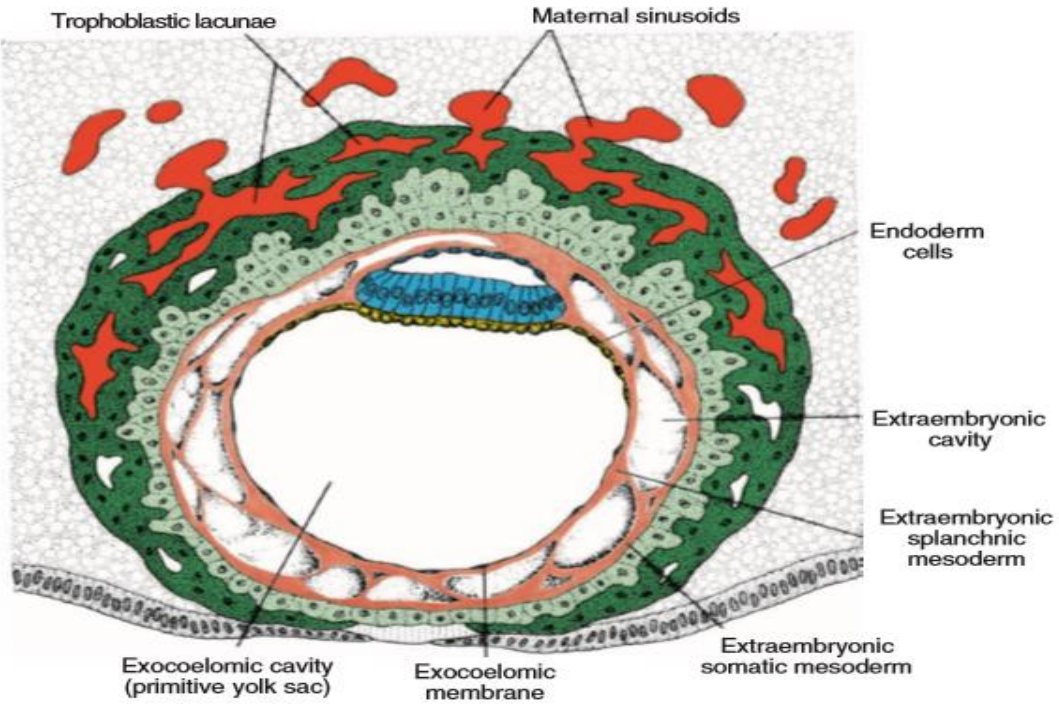

Figure 4.4 Human blastocyst of approximately 12 days. The trophoblastic lacunae at the embryonic pole are in open connection with maternal sinusoids in the endometrial stroma. Extraembryonic mesoderm proliferates and fills the space between the exocoelomic membrane and the inner aspect of the trophoblast.

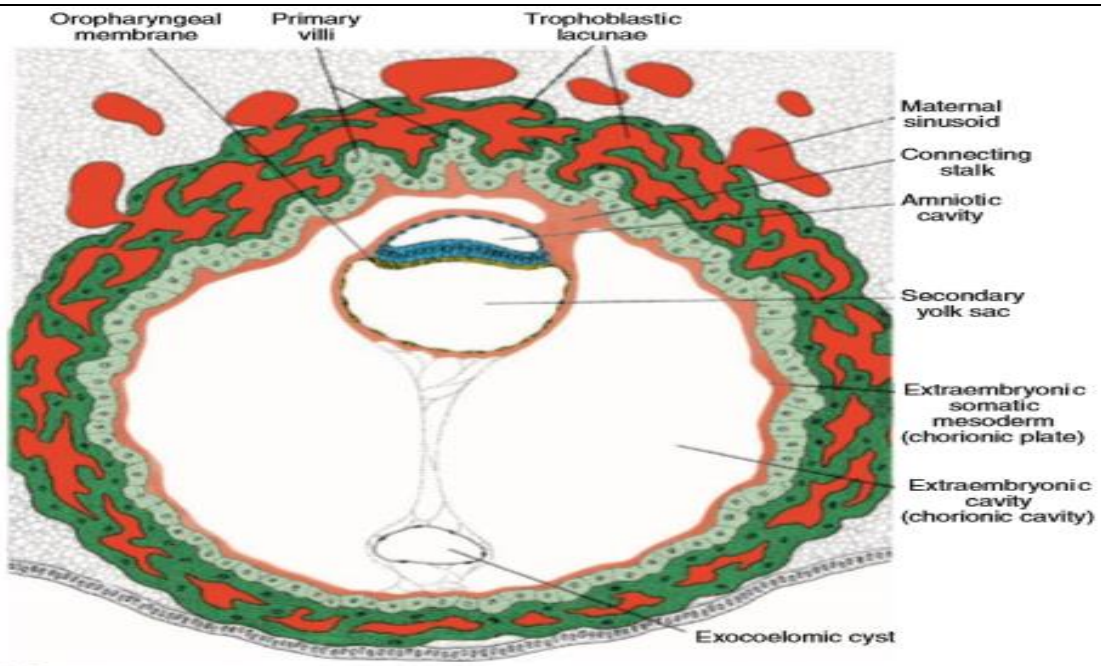

Figure 4.6 A 13-day human blastocyst. Trophoblastic lacunae are present at the embryonic as well as the abembryonic pole, and the uteroplacental circulation has begun. Note the primary villi and the extraembryonic coelom or **chorionic cavity**. The secondary yolk sac is entirely lined with endoderm.