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### Assignment Questions

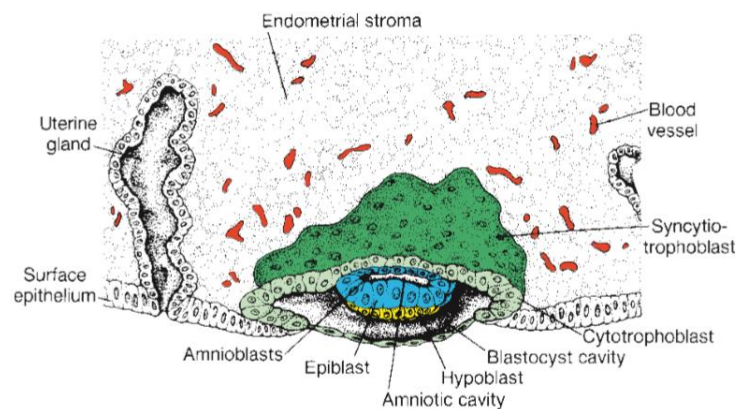
1. Discuss the second week of development.

### Answers

The second week of development can span from completion of implantation to the time the secondary yolk sac is formed.

Towards the end of the first week of development, implantation of the blastocyst begins first with the degeneration of the zona pellucida. This allows the trophoblast to attach to the endometrial epithelium of the uterus. The trophoblast proliferates rapidly and then can be differentiated into the cytotrophoblast and syncytiotrophoblast.

In the second week of development this process of implantation continues. At the 8<sup>th</sup> day of development the blastocyst is partially embedded into the endometrium. The erosive syncytiotrophoblast invades the endometrium and becomes partially embedded. While more cells of the cytotrophoblast move into the region of the syncytiotrophoblast and fuse with these cells.



Source: T.W. Sadler (2012) Langman's Medical Embryology 12<sup>th</sup> Edition

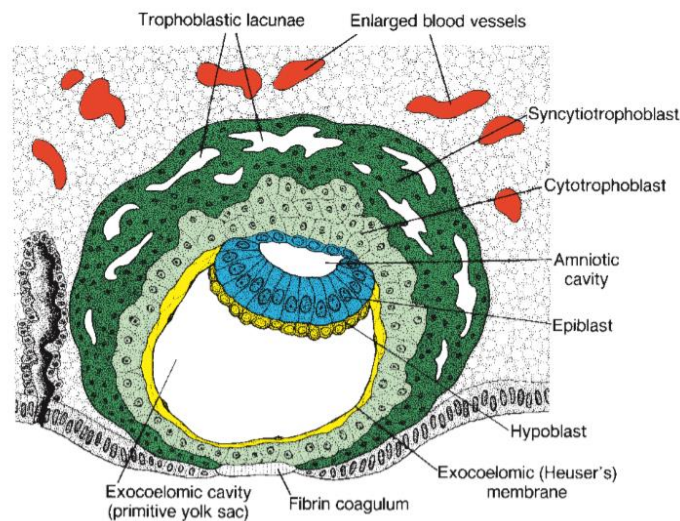
As implantation of the blastocyst progresses, a small space appears in the embryoblast which enlarges to form what is called the amniotic cavity. At the same time, the cells of the

embryoblast (also referred to as the inner cell mass) differentiate into two layers. These two layers are

- i) The hypoblast layer – This is a layer of small cuboidal cells adjacent to the blastocyst cavity.
- ii) The epiblast layer – This is a layer of high columnar cells adjacent to the amniotic cavity. The epiblast cells adjacent to the cytotrophoblast are called amnioblast

The hypoblast and epiblast layer form a flat ovoid disc and this is called the bilaminar embryonic disc.

By the 9<sup>th</sup> day of development the blastocyst is deeply embedded into the endometrium and the penetration defect is cover by a fibrin coagulum. The syncytiotrophoblast will continue to erode the endometrium and the cells of the cytotrophoblast will migrate into the syncytiotrophoblast. The trophoblast continues to progress in development and vacuoles appear. When these vacuoles fuse they form a trophoblastic lacunae. This stage of trophoblast development is referred to as the lacunar stage.



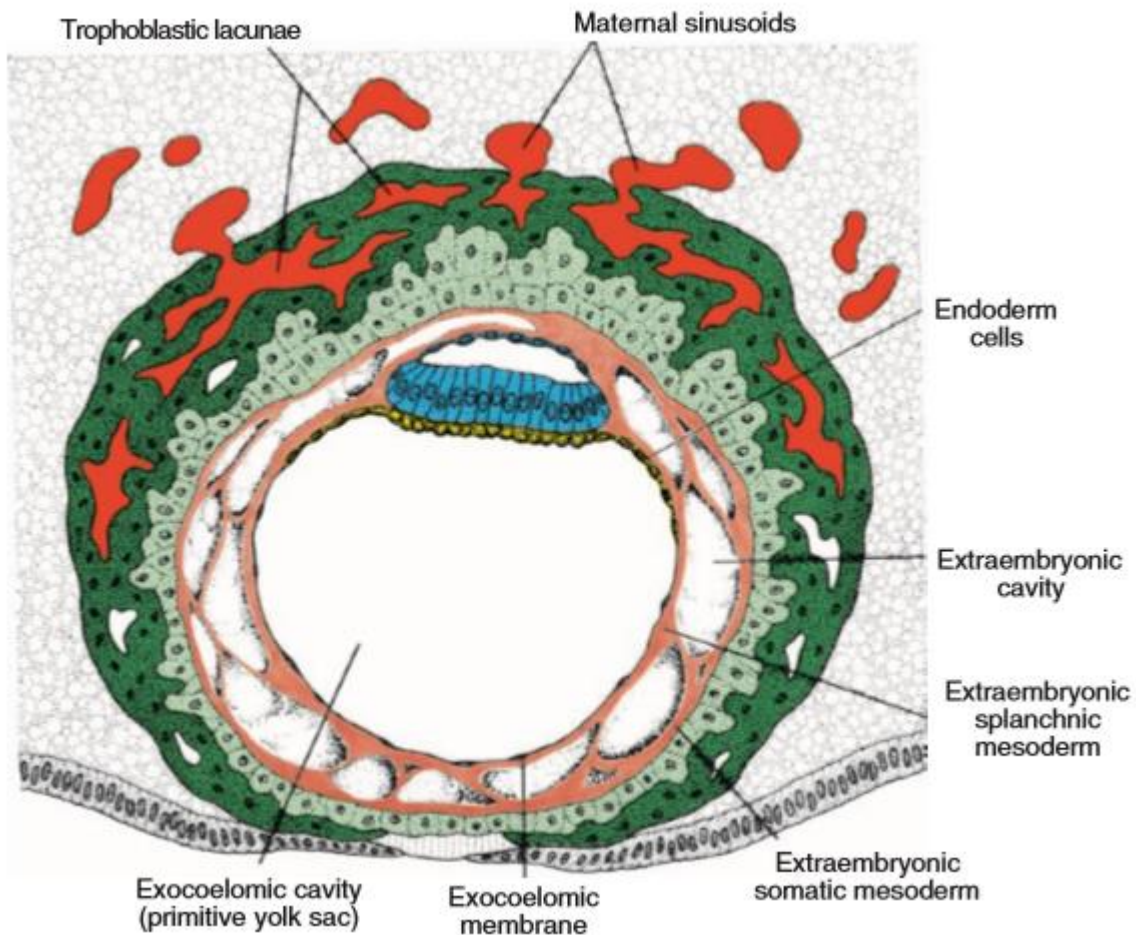
Source: T.W. Sadler (2012) Langman's Medical Embryology 12<sup>th</sup> Edition

The cells of the hypoblast layer adjacent to the cytotrophoblast form a thin membrane and this called Exocoelomic Membrane (or Heuser's Membrane). Between this membrane and the hypoblast is the Exocoelomic cavity (or Primary yolk sac/Primary umbilical vesicle). This is illustrated above.

Around the 11<sup>th</sup> to 12<sup>th</sup> day of development the blastocyst is completely embedded in the endometrium. The syncytiotrophoblast will continue to erode the endometrium and the cells of the cytotrophoblast will continue to divide and migrate into the syncytiotrophoblast. The surface epithelium almost covers the original defect. The cells of the syncytiotrophoblast have eroded the endothelial lining of maternal capillaries. These capillaries which are congested and dilated are

known as sinusoids. Ruptured sinusoids communicate with the trophoblastic lacunae hence we have blood from the mother mixing with the blastocyst. At this stage a Primordial Uteroplacenta Circulation is established.

A space of mesoderm develop between the cytotrophoblast and exocoelomic membrane except at a point where there is a connecting stalk. The space of the mesoderm is called Extraembryonic mesoderm. Inside the Extraembryonic mesoderm there are development of cavities called Extraembryonic coelom. This cavity divides the mesoderm into two different parts



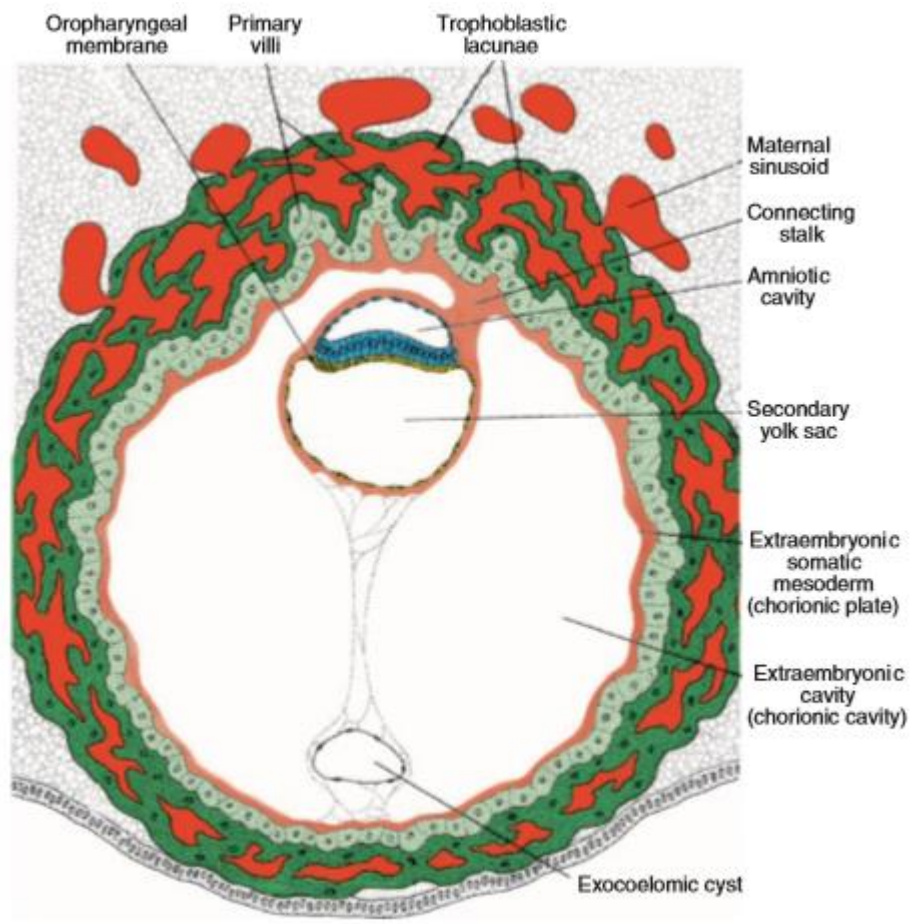
Source: T.W. Sadler (2012) Langman's Medical Embryology 12<sup>th</sup> Edition

- i) Extraembryonic somatic mesoderm – the part of the mesoderm that lines the region of the cytotrophoblast and amnion
- ii) Extraembryonic splanchnic mesoderm – the part of the mesoderm that lines the yolk sac.

Decidual reaction occurs as the cells of the endometrium transform, increasing in size because of the accumulation of glycogen and lipid in their cytoplasm. This is necessary to provide nutrition for the embryo and an immunological privileged site for the conceptus.

At the 13<sup>th</sup> day of development the surface defect is mostly healed. However bleeding occurs at the implantation as a result of increased blood flow in the lacunae space. This can often times be confused with menstrual bleeding as it is the 28<sup>th</sup> day of the cycle. Cells of the cytotrophoblast proliferate and penetrate into the syncytiotrophoblast, they are cellular columns covered in syncytium called Primary Villi.

The connecting stalk with development of blood vessels forms the future umbilical cord. The extraembryonic cavity becomes enlarged and is called the Chorionic cavity. As development continues, the primary yolk sac becomes smaller and it is called a secondary yolk sac. A small portion of the primary yolk sac is removed and this is called the exocoelomic cyst. This is illustrated below



Source: T.W. Sadler (2012) Langman's Medical Embryology 12<sup>th</sup> Edition

### Clinical Correlate

1. The syncytiotrophoblast is responsible for the production of the Human Chorionic Gonadotropin (hCG) which by the end of the 2<sup>nd</sup> week of development is sufficiently detected in radioimmunoassays as such serves as a basis of pregnancy testing.
2. Normally, the human blastocyst implants at the anterior or posterior wall of the uterus. Sometimes the blastocysts may implant at abnormal sites outside the uterus resulting in Ectopic pregnancy (extrauterine pregnancy) which may occur in the abdominal cavity, uterine tube or ovary. 95% of such pregnancies occur in the uterine tube often in the ampulla or isthmus.

Thus the three major events that take place in the second week of development include:

- 1) Completion of Implantation
- 2) Formation of a bilaminar germ disc
- 3) Development of extra embryonic structures

### References

1. Keith Moore et al (2016) The Developing Human Clinically Oriented Embryology 10<sup>th</sup> Edition. Published by Elsevier Incorporation, Philadelphia PA.
2. T. W. Sadler (2012) Langman's Medical Embryology 12<sup>th</sup> Edition. Published by Lippincott Williams & Wilkins, a Wolters Kluwer business