

NAME: NWACHUKWU CHINECHEREM OBIANUJU
MATRIC NO: 18/MHS91/236
DEPT: MBBS
LEVEL: 200

ASSIGNMENT
DISCUSS THE SECOND WEEK OF DEVELOPMENT

The **second week** of human **development** is concerned with the process of implantation and the differentiation of the blastocyst into early embryonic and placental forming structures. One of the most important features of the second week is the completion of **implantation** and establishment of **fetomaternal interactions**.

Implantation of the blastocyst

Implantation is a complex biochemical and mechanical process that begins in the first week of gestation and extends into the second week. There are many influencing factors that affect the process. These can be grouped into **maternal** and **embryonal factors**. However, both entities work synchronously in order to effectively achieve implantation. The process of implantation can be subdivided into three phases:

- There is a period of **apposition** where the blastocyst establishes weak interactions with the uterine wall.
- The **attachment** phase occurs when definitive binding of the blastocyst to the uterine epithelium is more established, such that the blastocyst cannot be flushed from the uterine cavity.
- Finally **invasion** occurs when the blastocyst begins to burrow into the endometrium.

This period usually occurs between the 19th and 24th day of the menstrual cycle. This coincides roughly with the 6th to 10th day following ovulation.

Maternal factors affecting implantation

In anticipation for successful fertilization each month, the inner uterine wall (**endometrium**) undergoes a series of changes in order to facilitate the blastocyst. Recall that there are three layers of the endometrium – the strata basalis, spongiosum and compactum.

The deepest layer is the **stratum basalis**, which functions as the regenerative layer and proliferates to form the stratum spongiosum and stratum compactum. **Stratum compactum** is the most superficial and the **stratum spongiosum** resides between the two. Together, the strata compactum and spongiosum form the **stratum functionalis**; which is the functional layer of the endometrium that facilitates implantation.

The development of the stratum functionalis is mitigated by surges in **estrogen** (which are released from the maturing ovarian follicle, under the influence of follicle stimulating hormone). If fertilization did not occur during the previous menstrual cycle, the fall in reproductive hormones result in the degeneration of the stratum functionalis. The shedding of this layer during the menstrual phase of the cycle accounts for the vaginal bleeding known as **menstruation**.

In the subsequent cycle, as follicle stimulating hormone levels rise and stimulate maturation of another ovarian follicle, the resultant increase in estrogen levels leads to proliferation of the stratum basalis. This is known as the **proliferative phase**, during which time there is thickening of the endometrium. Following an increase in luteinizing hormone and the release of a secondary oocyte, the remaining corpus luteum continues to release **estrogen** and **progesterone** to maintain the stratum functionalis. The spiral arteries of the uterus become longer and more tortuous under the influence of the sex hormones.

Following successful fertilization the uterine epithelia, which is characterized by **ciliated columnar cells with microvilli**, undergoes morphological changes to accommodate the growing embryo. The expression of these cilia (extended processes located at the apical aspect of the cells) is regulated by both progesterone and estrogen. The underlying motile microtubules allow the cilia to move the developing embryo toward a favourable site on the uterine wall. This process usually starts around the end of the first gestational week, when the conceptus is classified as a blastocyst.

The process of bringing the conceptus close to the uterine wall is referred to as **adplantation (apposition)**. As the blastocyst rolls along the surface of the uterus, the pole of the blastocyst with the inner cell mass is adjacent to the uterine wall. Early attachments to the **microvilli** (short, non-motile, apical epithelial processes) also facilitate the initiation of implantation.

Once the uterine lining is receptive for implantation, the endometrium is said to be in the **implantation window**. However, this is a complex process that depends on the presence of numerous cytokines, immunomodulators, and increased binding capacity of the epithelium in order for implantation to work. Recall from the first week of gestation that the resulting conceptus is genetically unique when compared with its

parents. Therefore, the mother's immune system should identify the blastocyst as a parasitic entity that should be destroyed.