

## EDITORIAL

# A Look at Early Human Embryonic Development and The Importance of Darkness for Embryogenesis

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## Abstract

Human development is a highly complex process where a single cell called zygote forms a multicellular body made up of trillions of cells. Human pregnancy takes about 10 lunar months or 40 weeks. Prenatal life is divided into three stages namely germinal, embryonic, and fetal stages. All stages are critical, but the most important is the embryonic stage through which embryogenesis occurs. It normally occurs in the upper segment of the uterus into its endometrium, called decidua after occurrence of conception. Many factors can

affect embryogenesis including the mother's use of medications and even the mother's psychological state. Of these factors, light may be. The embryo is surrounded by three regions of darkness These areas from the inside out are the amniotic cavity, the uterine cavity, and the abdominal cavity. Light could affect embryonic development either by direct toxic effect on the embryo, or indirectly by photo-oxidation of components in media. Therefore, it is necessary to study them in future studies to investigate the potentially harmful effect of light exposure on embryonic development. This may be useful to avoid potential obstacles to the IVF process as embryos can be exposed to light sources of varying intensity.

**Key Words:** *Embryogenesis; Germinal stage; Embryo; Fetus; Light and dark; Fertilization*

## Introduction

Human development is a highly complex process where a single cell called zygote forms a multicellular body made up of trillions of cells. Human pregnancy takes about 10 lunar months or 40 weeks. Fertilization, which is the fusion of the sperm with the mature egg, occurs in the distal third of Fallopian tube. Then, the

fertilized ovum called a zygote begins to develop through mitotic cell division as it moves toward the uterine cavity. This results in formation of solid mass of cells called morula of about 16-32 cells. Then, the morula acquires a fluid from the cavity of maternal genital ducts to form a cystic structure called blastocyst. Approximately, by the end of the first week, the developing blastocyst begins its implantation into the

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endometrium at the upper segment of the uterus. Such implantation becomes completed by the end of the second week. Here, this uterine site is located deep in the pelvic cavity which is the lower part of the abdominal cavity surrounded by the hip bones. This stage of prenatal development is called the germinal period and represents the first of the three prenatal stages. The embryonic stage represents the second stage of development before birth. This stage begins in the third week with the embryonic folding and changing its shape into a cylinder surrounded by amniotic fluid. During such embryonic stage, embryogenesis occurs with the establishment of most of the body's organs and systems. Therefore, it is a very critical stage in prenatal life and even in all human life. Any maternal use of an external drug or even any psychiatric disorders may affect fetal development and may lead to birth defects. After that, the fetal stage begins by the third lunar month and continues until birth. During this stage, the fetus begins to take on the human appearance and shape with the emergence of vitality and movements, as well as the maturation of various organs and systems, especially those necessary after birth such as the lungs [1].

The amnion is a thin, tough, and transparent membrane that surrounds a sac called the amniotic cavity enclosing the developing fetus. The cavity contains the amniotic fluid necessary for the proper growth of the fetus. Furthermore, amniotic fluid examination could lead to diagnosis of some prenatal disorders that might be alleviated or prenatally treated to avoid fetal loss [1].

The amniotic cavity represents the internal cavity of three cavities to ensure the darkness that surrounds the early stages of embryonic development. In this regard, [2] found in bola embryos that initial dark incubation improves efficiency rates at all embryo stages, especially

in first (globular) embryos which could increase more than 6 times. It has been suggested that light could affect embryonic development in some species either by direct toxic effect on the embryo, or indirectly by photo-oxidation of components in media [3]. In this regard, the early embryonic development occurs in the deepest part of abdominal cavity represented by the pelvis surrounded by pelvic bone. On the other hand, continuous exposure to light at incubation is significantly associated with shorter periods for hatching time of embryonic development of *Obscure Puffer* [4].

In addition to the inner darkness formed by the amniotic cavity, the other two cavities are represented from the inside out by the uterine cavity and then the abdominal cavity. The wall of each darkness also consists of three layers. The wall of the first internal darkness is formed of an amniotic membrane lining the other two layers represented by the chorion and decidua capsularis that be stretched and disappear as the fetus grows and increases in size (Figures 1 and 2). The second cavity is also lined by the three layers of the uterus made up of the decidua parietalis (the rest of the uterine lining away from the gestational sac), the myometrium and the peritoneum. The wall of last outermost darkness also consists of the three flat muscles forming the antero-lateral abdominal wall represented from outside to inside by the external oblique, the internal oblique, and the transversus abdominis. The muscle layer is lined by fascia transversalis and followed by the parietal layer of peritoneum [1,5].

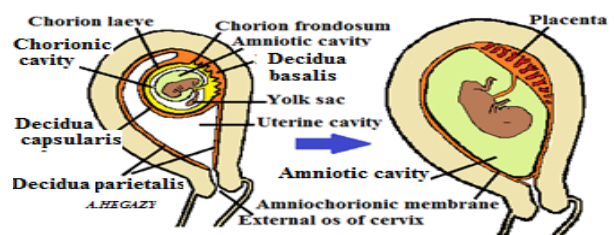
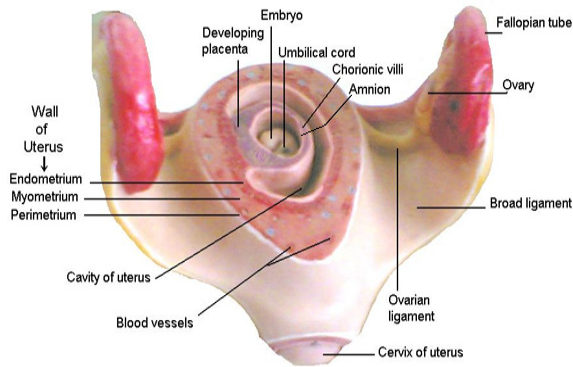


Figure 1) Diagram of sagittal sections in the pregnant uterus showing fetal membranes' development [1].



**Figure 2)** *Opened pregnant uterus showing embryonic development [1].*

The amniotic cavity initially appears as small cavities that unite to form a single cavity separating the trophoblast from the embryonic ectoderm. Hence, its floor consists of the ectoderm, and is covered by another new layer of cells called the amnion or amniotic membrane which is likely derived from the trophoblast above it. Amniotic fluid arises from several sources including maternal plasma, amniotic membrane secretion, and the contribution of the fetus through urination and defecation to the amniotic fluid. Therefore, any fetal disorder that affects the swallowing and discharge of the digestive system as well as the urinary system can affect its volume and therefore measuring its size may reflect some congenital anomalies. Amniotic fluid is mainly composed of 99% water with only 1% of the other ingredients. This 1% constituents include nutrients such as glucose, amino acids and fatty acids, urinary waste

products like urea, and shed cells. The source of these cells is the amnion, or of embryonic origin such as the fetal skin and urinary bladder.

With the increased growth of the fetus, the uterine cavity is obliterated with the enlargement of the gestational sac. The uterus swells in size with the growth of the fetus under the influence of placental hormones, especially estrogen. The level of the fundus of the uterus reaches the diaphragm. Hence, the uterus becomes pelviabdominal organ; and the gestational sac becomes separated from the outside only by the abdominal and uterine walls.

## Conclusion

Embryonic development is a very complex process. It occurs in a deep place in the abdominal cavity and is surrounded by regions of darkness. These areas from the inside out are the amniotic cavity, the uterine cavity, and the abdominal cavity. Many factors can affect embryogenesis. Of these factors, light may be. Therefore, it is necessary to be studied in future studies to confirm the effect of light exposure on embryonic development. This may be useful to avoid potential obstacles to the IVF process as embryos can be exposed to light sources of varying intensity.

**Conflict of Interest:** None.

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