

Chapter 2

GENERAL EMBRYOLOGY

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OUTLINE

- ◆ Introduction to general embryology
- ◆ Gametes and gametogenesis
- ◆ Fertilization and cleavage
- ◆ Blastogenesis and implantation
- ◆ Events of the second week of pregnancy
- ◆ Period of organogenesis
- ◆ Case study
- ◆ SAQ
- ◆ MCQ
- ◆ Answer to questions

INTRODUCTION TO GENERAL EMBRYOLOGY

- ◆ The initial 8 weeks of pregnancy is the embryonic period and is very critical. At the end of this period, the primordia (anlages) of most organs and tissues have been laid down.
- ◆ Week 9 to birth is the foetal period, when developing organs mature and attain definitive status.
- ◆ Exposure of embryo to teratogens (certain drugs, irradiation, etc) can trigger formation of congenital anomalies.
- ◆ Key post-fertilization events of the first 8 weeks of pregnancy include blastogenesis, implantation, development of chorionic villi, gastrulation, neurulation, and differentiation of germ layers (endoderm, mesoderm and ectoderm).

GAMETES AND GAMETOGENESIS

(Fig. 2.1)

- ◆ The male gamete is the spermatozoon or sperm cell. It is elongated and highly motile
- ◆ The female gamete is the ovum. It is round and immotile
- ◆ The process that converts a spermatogonium to spermatozoon is spermatogenesis. It occurs in the seminiferous tubules of a mature male
- ◆ Successive stages of spermatogenesis include: mitosis (spermatocytosis), meiosis and spermiogenesis (or spermateliosis)

- ◆ Oogenesis (ovogenesis) is the process that leads to the formation of the ovum. This process starts in utero, is suspended in the prepubescent postnatal years, and resumes at puberty. Between puberty and menopause, an ovum is typically released in each menstrual cycle
- ◆ When on oral contraceptive however, the menstrual cycle becomes anovulatory

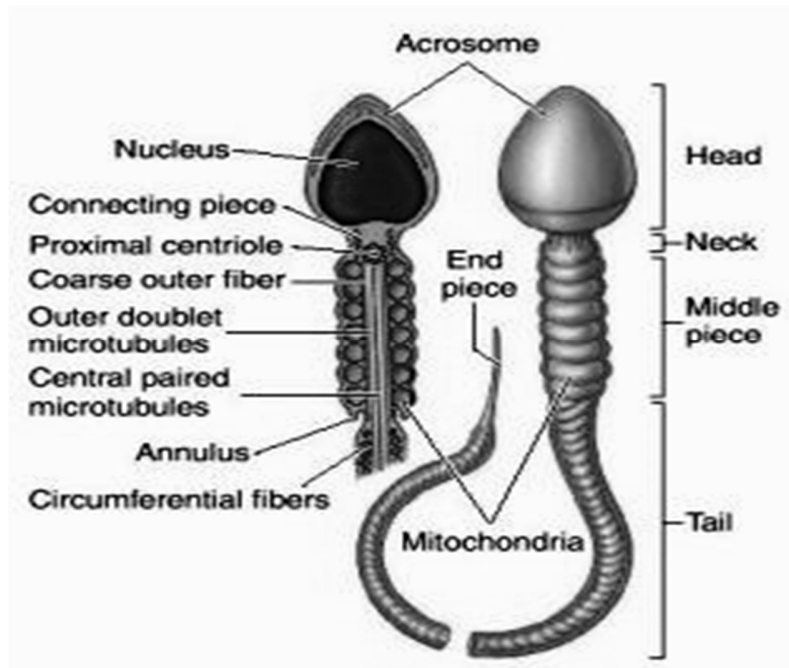


Figure 2.1 Human spermatozoon.

FERTILIZATION AND CLEAVAGE

- ◆ Conception starts at fertilization, when the male and female gametes fuse to form a unicellular diploid cell called **zygote**. This usually occurs in the ampullary region of the uterine tube
- ◆ Cleavage is the series of mitotic cell divisions that converts a unicellular zygote to a multicellular **morula** (Fig. 2.2). Each cell of the morula is termed a blastomere
- ◆ If the two daughter cells from the first mitotic division of the zygote continue to develop independently, monozygotic twins will result

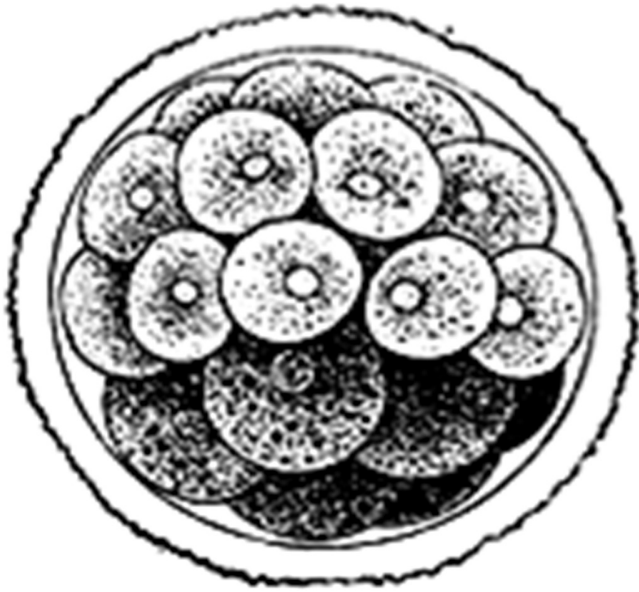


Figure 2.2 The morula

BLASTOGENESIS AND IMPLANTATION

- ◆ Blastogenesis occurs in the uterine cavity. It is the conversion of a morula to a fluid-filled blastocyst. Cells of the blastocyst are arranged as inner embryoblast and outer trophoblast
- ◆ At around the 6th day post-fertilization, the blastocyst begins to implant. Implantation is the embedding of the conceptus (embryo and associated membranes) into the endometrium. The process is completed in the 2nd week of pregnancy
- ◆ Ectopic pregnancy occurs when the conceptus implants outside the uterus, usually in the uterine tube

EVENTS OF THE SECOND WEEK OF PREGNANCY

(Fig. 2.3)

- ◆ In the 2nd week of pregnancy, implantation of the conceptus is completed; the bilaminar embryo (consisting of the hypoblast and epiblast) is formed; and a primitive uteroplacental circulation is established
- ◆ Weeks 1 and 2 constitute the pre-embryonic stage of development

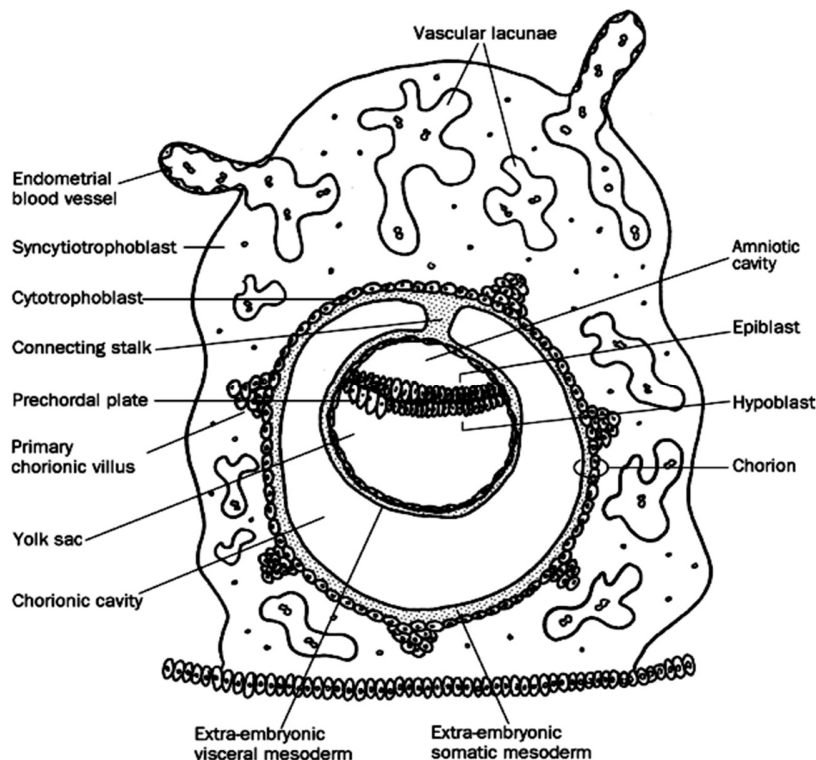


Figure 2.3 The embryo and its membranes at 12 days post-fertilization.

PERIOD OF ORGANOGENESIS (EMBRYONIC PERIOD; 3RD – 8TH WEEKS)

- ◆ Weeks 3 – 8 constitute the embryonic period of development or the period of organogenesis
- ◆ In the 3rd week of development, the following major events occur: gastrulation, neurulation, and angiogenesis. The 3 germ layers (endoderm, mesoderm, ectoderm) formed at gastrulation are the sources of all the tissue of the embryo
- ◆ In the organogenetic period, primordia of all tissues and organs of the body are established from the three germ layers formed at gastrulation
- ◆ Ectoderm forms epidermis and its appendages, as well as the nervous system
- ◆ Endoderm forms the parenchyma of the thyroid and parathyroid glands, as well as the glands of the gastrointestinal tract (GIT) and respiratory system (RS). It also forms the epithelia of the GIT and RS
- ◆ Mesoderm forms the excretory organs, connective tissue stroma of glands and several organs; and the linings of the pericardial, pleural and peritoneal cavities, dermis, and the bulk of the skeletal muscles
- ◆ During the organogenetic period, the embryo is highly susceptible to teratogenic insults that may induce birth defects. These insults include drugs, certain environmental agents and genetic factors

CASE STUDY

A sexually-active woman has not been pregnant in the last 5 years because she is on oral contraceptive pills (OCPs). She visited her doctor to get advice on certain changes she noted in recent times, and indicated her readiness to stop the medication as she prepares to have her first baby.

- a. Why has the woman not been able to conceive while on the OCPs?
- b. How would you explain the fact that the woman still menstruates while on the OCPs?
- c. What hormonal changes will occur once the OCPs are stopped; and how would these changes facilitate pregnancy?

SAQ

The placenta is an accessory structure with maternal and fetal components. Highlight the processes involved in its formation; and explain its obstetric importance and fate.

MCQ (T/F)

Which of these statements are correct?

- a. Ovary releases an ovum around middle of menstrual cycle
- b. Spermatogonia and oogonia are normally found in adult gonads
- c. Primordia of the brain arises in the 3rd week post-fertilization
- d. Oestrogens levels are highest in the secretory phase of menstrual cycle
- e. Corpus luteum is indispensable in the first trimester of pregnancy

MCQ (1 in 5 Questions)

During early embryonic development, which of these is correct?

- a. Syncytiotrophoblast is an endocrine organ
- b. Cleavage largely occurs in the uterine cavity
- c. Ovum undergoes post-fertilization capacitation
- d. Uteroplacental circulation normally begins in the 5th week
- e. Corpus luteum rapidly involutes

Answers

T/F

- (a) F
- (b) F
- (c) T
- (d) F
- (e) T

One in Five

Option 'a' is the best answer