Oral histology
Second stage
Assis. Lec. Noor Natik

Lec, 1 First week of development

Ovulation and implantation

Human embryogenesis is a complicated process by which the fertilized egg develops into an embryo it's the branch of biology that studies the development of gametes (sex cells), fertilization, and development of embryos and fetuses . Additionally, embryology is the study of congenital disorders that occur before birth. Human embryology is the study of this development during the first eight weeks after fertilization. The normal period of gestation (pregnancy) is nine months or 38 weeks. Embryogenesis covers the first eight weeks of development; at the beginning of the ninth week the embryo is termed a fetus . In comparison to the embryo, the fetus has more recognizable external features and a more complete set of developing organs.During the first eight weeks of development, the concepts shifts from a single-celled zygote into a multi-leveled, multi-dimensional fetal body plan which utilizes primitively functioning organs. The female reproductive system The female reproductive system is made up of the internal and external sex organs that function in human reproduction. These organs are involved in the production and transportation of gametes and the production of sex hormones. The female reproductive system also facilitates the fertilization of ova by sperm and supports the development of offspring during pregnancy and infancy.The female reproductive system is immature at birth and develops to maturity at puberty to be able to produce gametes, and to carry a fetus to full term.

The human female reproductive system performs the following functions a) Formation of eggs b) Reception of sperms during copulation c) Providing a conducive environment for fertilization d) Providing shelter and nourishment to the growing embryo The first week of embryonic development is filled with an eclectic arrangement of physical and biochemical changes. Each step is a part of a cascade of events that must be intricately coordinated in order to produce a healthy baby at the end of the thirty eight to forty week period. However, the events of the first week of gestation are highly dependent on prior events that create the ideal environment for fertilization and implantation to occur.

Some of the important events that comprise the first week are:

- ♣ Gamete approximation
- ♣ Contact and fusion of gametes
- ♣ Fertilization
- ♣ Mitotic cleavage of the blastomeres
- ♣ Morula formation
- ♣ Blastocyst formation
- ♣ Implantation of the blastocyst.

At puberty, the female begins to undergo regular monthly cycles controlled by the hypothalamus which secretes gonadotropins. These hormones, follicle-stimulating hormone (FSH) and luteinizing hormone (LH), stimulate and control cyclic changes in the ovary. At the beginning of each ovarian cycle, 15 to 20, follicles are stimulated to grow under the influence of FSH. Under normal conditions, only one of these follicles reaches full maturity, and only one oocyte is discharged; the others degenerate and become atretic. When a follicle becomes atretic, the oocyte and surrounding follicular cells degenerate and are replaced by connective tissue.

Ovulation

In the days immediately preceding ovulation, under influence of FSH and LH, the follicle grows rapidly to become a mature vesicular graafian follicle,the surface of the ovary begins to bulge locally, Before ovulation, the oocyte and some cells of the cumulus oophorus (Cumulus oophorus is a cluster of cells that surround the oocyte both in the ovarian follicle and after ovulation) dettach from the inside of the distended follicle. At ovulation, there is a "surge" of LH release, the stigma balloons out, forming a surface vesicle, then it ruptures, expelling the oocyte with follicular fluid. The oocyte is covered by the zona pellucida and one or more layers of follicular cells which radially arrange themselves as the corona radiate. After ovulation the follicle turns into the corpus luteum which is made up of large conical yellowish cells. Corpus luteum serves as a temporary endocrine gland, by releasing female sex hormones namely progesterone and estrogen. The corpus luteum reaches máximum development approximately 9 days after ovulation. It can easily be

recognized as a yellowish projection on the surface of the ovary. Subsequently, the corpus luteum shrinks and forms a mass of fibrotic scar tissue, the Corpus albicans

While the follicle and ovum are maturing, the follicle secretes hormones that prepare the uterine lining (the endometrium). The endometrium gets thicker and is well supplied with blood vessels.If fertilization does not occur, or for any other reason a blastocyst (future embryo) fails to implant within the endometrium, the built-up endometrial lining degenerates . The egg that is released is picked up by the fimbriae of the uterine tube(fingerlike projections at the end of the fallopian tubes, through which eggs move from the ovaries to the uterus), and the egg is transported toward the uterus. If fertilization does not occur, the egg degenerates, and menstruation occurs.

Fertilization

Fertilization is commonly known as conception ,is a process by which male and female gametes fuse, occurs in the ampulary region of the uterine tube(the widest part of the tube and is clóse to the ovary). Once the fertilized gamete (ovum) implants itself in the uterine lining, pregnancy begins. The process of fertilization occurs in several steps and the interruption of any of them can lead to failure.

Prior to fertilization, sperm undergo a process of capacitation in response to conditions in the female reproductive tract, which include increases in motility and destabilization of the cell membrane that allows the head of the sperm to penetrate the egg.

Capacitatíon is a period of conditioning in the female reproductive tract .Much of this conditioning during capacitation occurs in the uterine tube and involves epithelial interactions between the sperm and the mucosal surface of the tube.. Only capacitated sperm can pass through the corona cells and undergo the acrosome reaction.

Acrosome reaction The acrosome reaction, which occurs after binding to the zona pellucida, is induced by zona proteins. This reaction culminates in the release of enzymes needed to penetrate the zona pellucida, including acrosin- and trypsin-like substances.

Phases of fertílization :

Phase I: Penetration of the corona radiata Of the 200 to 300 million spermatozoa deposited in the female genital tract,only 300 to 500 reach the site of fertilization. Only one of these fertilizes the egg. It is thought that the others aid the fertilizing sperm in penetrating the barriers protecting the female gamete. Capacitated sperm pass freely through corona cells .

Phase II : Penetration of the zona pellucida The zona is a glycoprotein shell surrounding the egg that facilitates and maintains sperm binding and induces the acrosome reaction. Release of acrosomal enzymes (acrosin) allows sperm to penetrate the zona, thereby coming in contact with the plasma membrane of the oocyte.Permeability of the zona pellucida changes when the head of the sperm comes in contact with the oocyte surface. This contact results in release of lysosomal enzymes from cortical granules lining the plasma membrane of the oocyte.In turn, these enzymes alter properties of the zona pellucida (zona reaction).

Phase III :Fusion of oocyte and sperm cell membrane The plasma membranes of the sperm and egg fuse,because the plasma membrane covering the acrosomal head cap disappears during the acrosome reaction, actual fusion is accomplished between the oocyte membrane and the membrane that covers the posterior region of the sperm head.

Results of fertilization :

A- Restoration of the diploid number of chromosomes, half from the father and half from the mother. Hence, the zygote contains a new combination of chromosomes different from both parents.

B -Determination of the sex of the new individual. An X-carrying sperm produces a female (XX) embryo, and a Y-carrying sperm produces a male.

(XY) embryo. Hence, the chromosomal sex of the embryo is determined at fertilization.

C- Initiation of cleavage : Following fertilization a series of rapid cell divisions called cleavage occur with no significant growth and decrease

the cells' size with each subsequent division and produces a cluster of cells that is the same size as the original zygote. At least four initial cell divisions occur, resulting in a dense ball of at least sixteen cells called the morula. The different cells derived from cleavage, up to the blastula stage, are called blastomeres.