

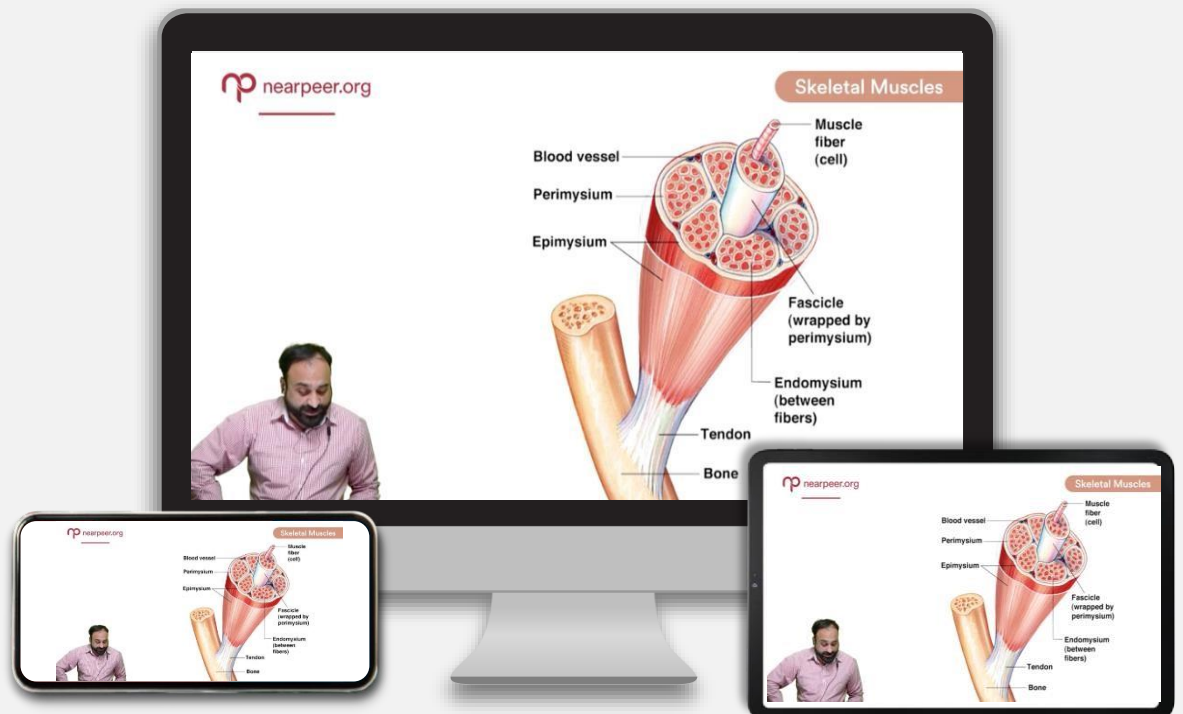
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Reproduction

Learning Objectives:

Male reproductive system

Female reproductive system (including menstrual cycle)

Sexually transmitted disease

Reproduction

Reproduction is a process through which organisms produce young ones of their own kind to maintain their species. Reproduction is of two types, asexual reproduction and sexual reproduction.

Asexual reproduction:

It is a kind of reproduction in which a single organism gives rise to offspring by mitotic cell division, during which the total number of chromosomes is exactly replicated and passed on to the daughter cells, so that the offspring are genetically identical to the parent.

Advantages:

- (i) The offspring are genetically identical to the parent.
- (ii) Increase in number is very rapid.
- (iii) Tissue culturing in plants and cloning in animals are very easy.

Disadvantages:

- (i) It is not good for survival of a species.
- (ii) In the cloning there is rapid aging and low resistance to environmental stress and diseases. Similarly cloning is still not being accepted socially and morally in general.

Sexual Reproduction:

It is a kind of reproduction in which usually two parents are involved and a fertilized egg is produced through the union of meiotically produced specialized sex cells (egg and sperm) from each parents.

Advantage:

Meiosis or reduction division gives rise to spores (sporogenesis) or gametes (gametogenesis). As a result, the chromosome number is halved (haploid). Similarly reshuffling of genes also occur which lead to new recombination of genes.

This not only maintains the chromosome number in a species but also produce genetic variations. It is an important factor in the survival of a species or a population.

Asexual Reproduction	Sexual Reproduction (Omitting Bacteria)
One parent only	Usually two parents
Offspring produced by mitotic cell division.	A fertilized egg is produced by the union of meiotically produced specialized sex cells (egg and sperm) from each parents. From this fertilized egg an organism is produced by the process of mitosis
No gametes are produced	Gametes are produced. These are haploid and nuclei of two gametes fuse (fertilization) to form a diploid zygote
Meiosis absent and the complete number of chromosomes is exactly replicated and passed on to the next generation	Meiosis present at some stage in life cycle. Meiosis or reduction division gives rise to gametes (gametogenesis) in which not only the chromosome number is halved (haploid). In this way the chromosome doubling in every generation is prevented
Offspring genetically identical to the parent	Offspring show genetic variation which is an important factor in the survival and adaptation of species or a population
Commonly occurs in plants, less differentiated animals and micro-organisms Absent in more differentiated animals	Occurs in the majority of plant and animal species
Often results in rapid production of large numbers of offspring	Less rapid increase in numbers.
Methods of asexual reproduction are fission, sporulation, budding, vegetative propagation, artificial propagation, parthenogenesis and apomixes etc. The layering, grafting, budding etc are the artificial asexual methods of reproduction in plants	

Evolution of Sexual Reproduction:

Asexual method of reproduction is a primitive form of reproduction. Later on a mechanism was evolved leading to the production and union of gametes. First isogamy & then Heterogamy was evolved.

Evolution of sexual reproduction also leads to the differentiation of sexes (male or female). Fertilization is the process which leads to union of gametes. Fertilization may occur outside the body (external fertilization) or inside the body of the female (internal fertilization). In terrestrial

conditions fertilization is internal. Sperms are lodged in the female body where fertilization occurs.

After internal fertilization sometimes there is external development as in reptiles and birds. They lay shelled eggs to protect the developing embryo from harsh terrestrial conditions. Such animals are called oviparous,

In mammals, internal fertilization leads to internal development and development of embryo occurs inside the female body, which give birth to young one such animals are called **viviparous**. In some mammals like Duckbill platypus (Echidna), internal fertilization leads to internal development of the young one in a shelled egg and when development is completed shelled egg is laid which hatches the offspring. This is called **ovoviviparous** condition. Viviparous and ovoviviparous animals provide more protection to their young one during development.

Reproduction in Man:

Male and female have separate reproductive systems.

Male Reproductive System:

Male reproductive system consists of external genitalia which consist of:

- (i) A pair of testes.
- (ii) Male reproductive organ which IS used to transfer the sperms into the female reproductive tract.
- (iii) Various accessory glands

Testes:

Location:

Testes lie outside the body in the sac like scrotum.

Seminiferous Tubules:

Each testis consists of a highly complex duct system called seminiferous tubules.

Sperm Production:

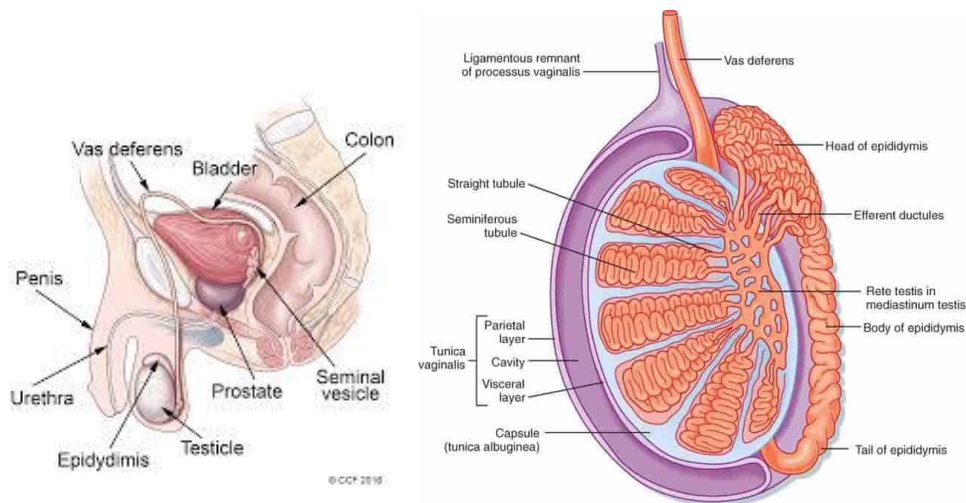
In the seminiferous tubules repeated division by the cells of the germinal epithelium produce spermatogonia. These increase in size and differentiate into primary spermatocytes. Meiosis occurs in the primary spermatocytes to form secondary spermatocytes and spermatids. Finally, the spermatids differentiate into mature sperms.

Hormone Production:

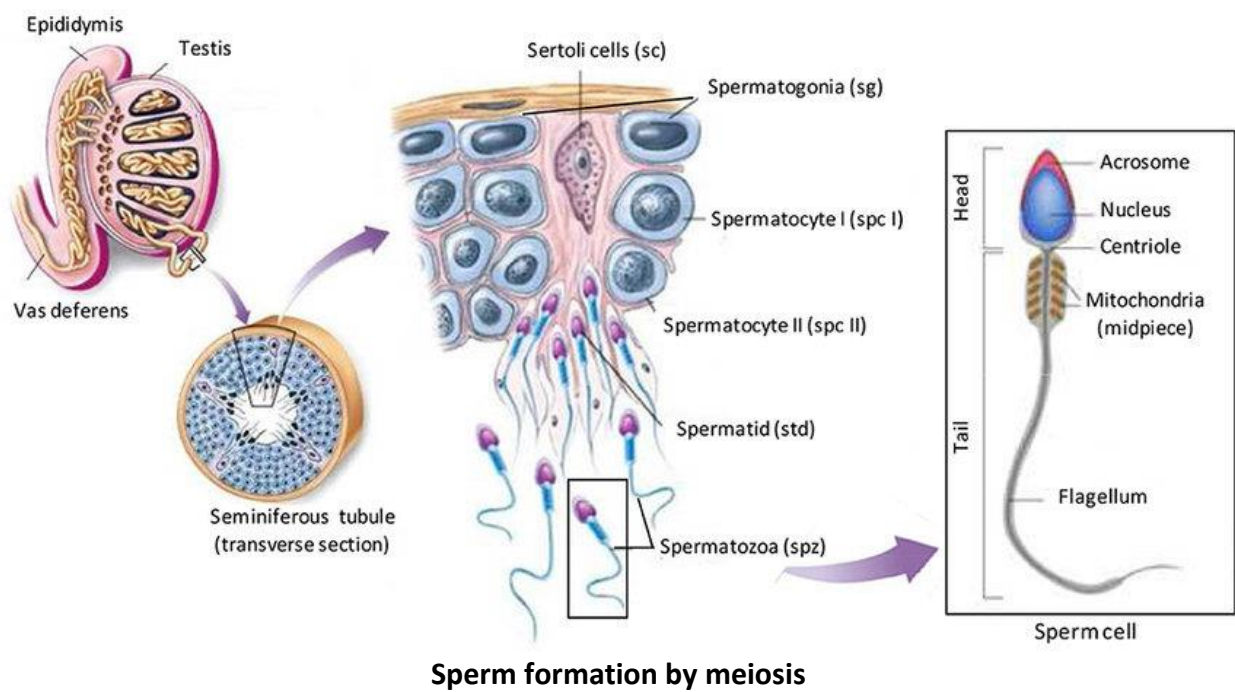
Between the seminiferous tubules are interstitial cells which secrete testosterone. This hormone is essential for the successful production of sperms and also controls the development of male secondary sexual characteristics during puberty.

Sperm Storage:

Fluid secreted by sertoli cells provides liquid medium, protection and nourishment to sperms while they are in the tubules. The sperms are then transferred to the main duct of the male reproductive tract, the vas deferens which forms highly convoluted epididymis. The sperms then pass through the urinogenital duct and are discharged out.



The male reproductive system consists of two testes that produce sperms, ducts that carry the sperms, and various glands.



Female Reproductive System:

The female reproductive system consists of

- | | | | |
|-------|-----------------|------|--------------------|
| (i) | Pair of ovaries | (ii) | Pair of oviducts |
| (iii) | Uterus | (iv) | External genitalia |

Ovaries:

A pair of ovaries lies within the body cavity of the female

Egg Production:

Germ cells in the ovary produce many oogonia which divide by mitosis to form primary oocytes. These are enclosed in groups of follicle cells. The primary oocyte divides meiotically into the haploid secondary oocyte and first polar body. Second meiotic division in the oocyte proceeds as far as metaphase but is not completed until the oocyte is fertilized by the sperm.

Ovulation:

Discharge of ovum from the ovary is called ovulation. In human only one ovum is usually discharged from the ovary at one time.

- (ii) **Oviduct / Fallopian Tube:** The ovum is then transferred to the oviduct generally called fallopian tube or uterine tube. The fertilization of the ovum takes place in the proximal part of the oviduct.
- (iii) **Uterus:** The uterine tube opens into the uterus. The fertilized ovum (zygote) enters the uterus where it is implanted (conceived) and undergoes further development. A placenta is established between the uterine and foetal tissues for the exchange of oxygen, carbon dioxide, waste, nutrients and other materials.
- (iv) **External Genitalia:** Uterus opens into the vagina through cervix. Urethra and vagina have independent openings to the exterior.

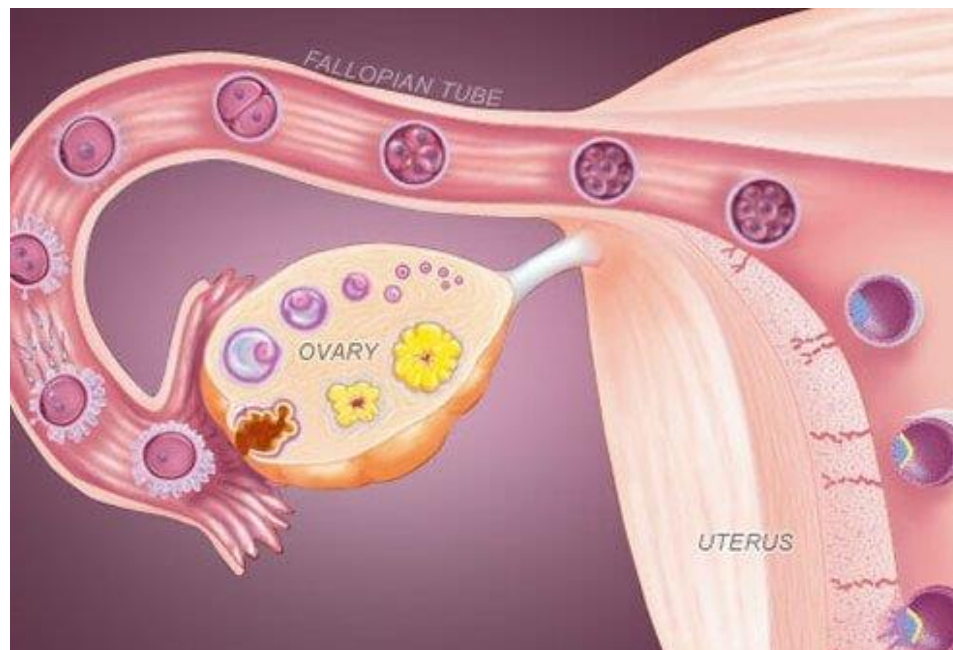
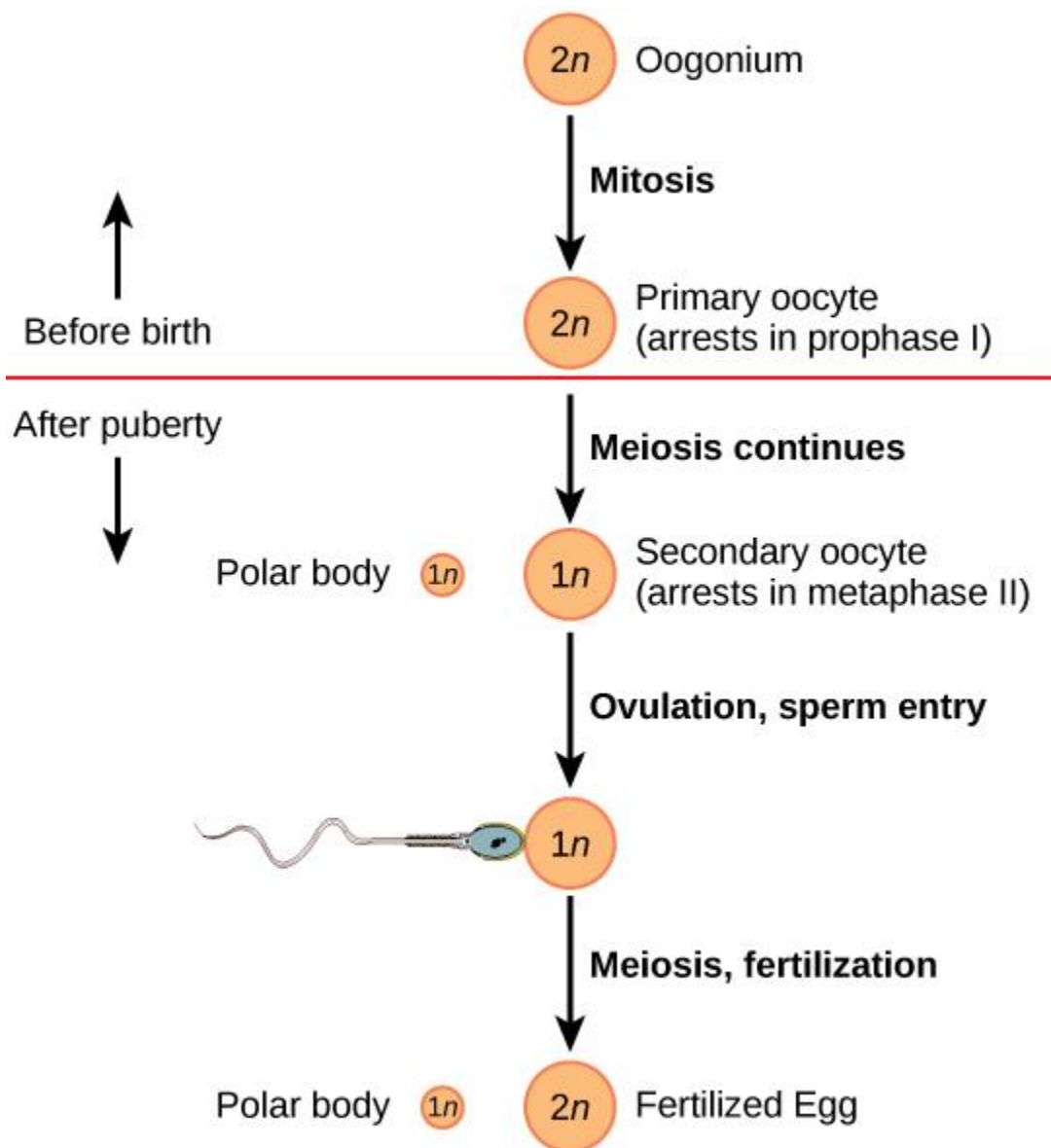


Fig. The human female reproductive system



Female Reproductive Cycle:

- In female, production of egg is a cyclic activity. However, in males, the gamete production and release is a continuous process beginning at puberty and lasting throughout life.
- The 28 days periodic reproductive cycle in which structural and physiological changes occur in the whole reproductive system of the female is called menstrual cycle.

The cycle is divided into four phases. The events of the menstrual cycle involve the ovaries cycle and the uterus (uterine cycle) and these are regulated by pituitary gonadotropin hormone.

Stages of female reproductive cycles are:

1. Role of FSH:

The pituitary gland on the start of puberty, releases follicle stimulating hormone (FSH). This hormone stimulates the development of several primary follicles. Only one of these follicles continues to grow with its primary oocytes while the rest break down by a degenerative process known as follicle atresia.

2. Role of Estrogen:

The ovary under the stimulus of FSH, also produce estrogen hormone. It has following functions:

- (i) It stimulates the endometrium (internal lining of the uterus wall) and vascularize it.
- (ii) It inhibits the secretion of FSH from pituitary gland.

3. Role of LH:

Decrease of FSH and increase of estrogen, causes the pituitary gland to secrete luteinizing hormone (LH) which induces ovulation. The release ovum from the follicle is called ovulation if release of a secondary oocyte (ovulation) is coincided with the thickening of the uterus.

4. Role of Progesterone:

The following cells after release of the egg are modified to form a special structure called corpus luteum. The yellowish glandular structure starts secreting a hormone called progesterone. It has following functions.

This hormone develops the endometrium and makes it receptive for the implantation of the zygote (placenta formation).

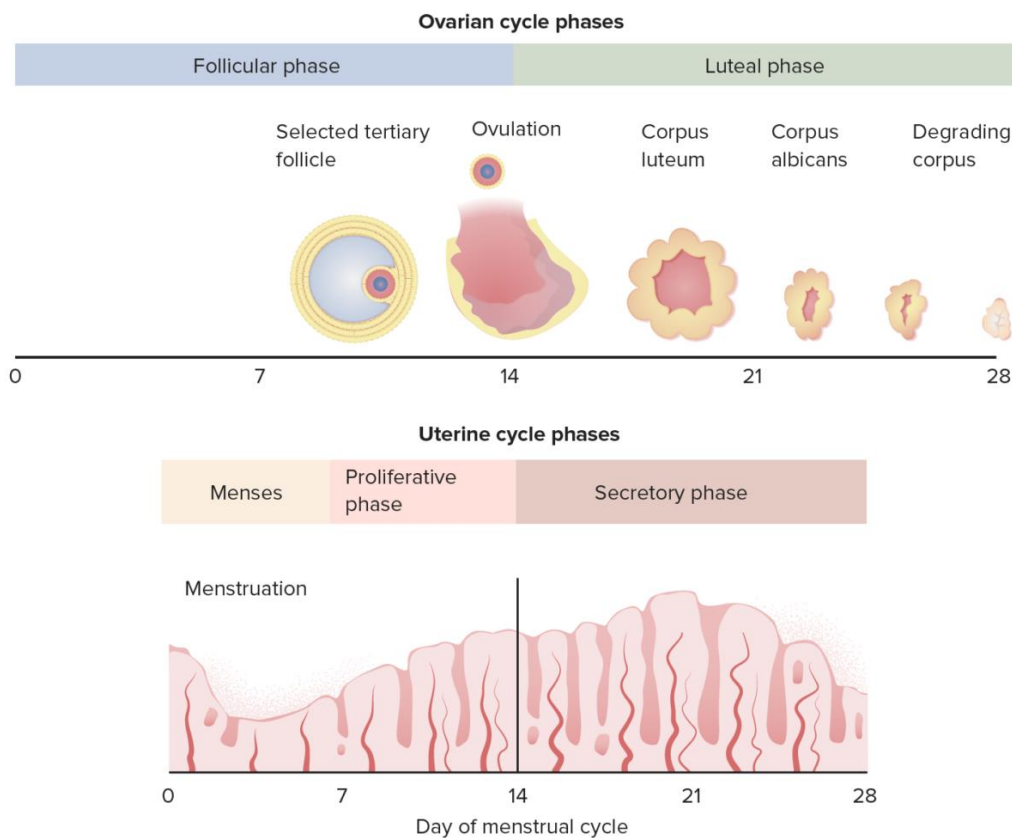
The uterine cycle in humans involves the preparation of the uterine wall to receive the embryo if fertilization occurs. Knowing how these two cycles are correlated, it is possible to determine when pregnancy is most likely to occur.

If fertilization does not occur, the corpus luteum starts degenerating. The progesterone secretion reduces and its effect on the spongy endometrium is reduced, which suffers a breakdown, this cause the discharge of blood and cell debris known as menstruation. This stage usually lasts for 3 – 7 days. The cycle is thus completed and the uterus is ready to enter into the next cycle

Period of Menstrual Cycle:

The human menstrual cycle generally repeats every 28 days although there is variation in different individuals or even within the same individual at different times of her age.

The end or complete stop of the menstrual cycle is called menopause after which the female stops producing the ova. Malnourishment and emotional stresses, effect the female reproductive cycle, which may be disturbed. The cycle is not completed in its normal 28 days.



The ovarian and uterine cycles in human female

Oestrous Cycle

Introduction:

Oestrous cycle is a reproductive cycle found in all female mammals except human being

Definition:

The cyclic structural and physiological changes which occur in the female reproductive tract from one period of estrous to the next is called oestrous cycle.

Explanation:

In this cycle, the estrogen production prepares the uterus for conception partly and also follicle develops ova. At this stage, female needs a physical stimulus of mating for ovulation. She exhibits the desire for mating or is said to be on "**heat**".

Birth:

Gestation Period:

The total gestation period (pregnancy) is usually about 280 days.

Secretion of Progesterone:

Once the placenta is established, it starts secreting the progesterone hormone which maintains the pregnancy.

Premature Births or Miscarriage:

Any disturbance in the secretion of progesterone may lead to premature births or miscarriage. Human embryo is enclosed in amniotic sac filled with amniotic fluid (protective and shock absorptive).

Placenta:

It is a structure which develops between the developing child and the uterus. It develops partly from tissue of the uterus and partly from the extra embryonic membrane of the developing child. The embryonic blood vessels that supply nutrients to the developing child and remove metabolic wastes are separated from the blood vessels of the mother. Because of this separation, the placenta can selectively filter different materials and micro-organisms.

Secretion of LTH and Placental Lactogen:

During this period pituitary gland produce luteotropic hormone (LTH). Placenta also secretes human placental lactogen. Both these hormones stimulate mammary development in preparation for **lactation**.

Fetus Formation:

From beginning of the 3rd month of pregnancy the human embryo is referred to as the fetus. Most of the major organs are formed by the 12th week of pregnancy and the remainder of the gestation period is taken up by growth.

Onset of Birth:

It was thought that hormonal activities within the mother i.e., decrease in progesterone level onset the birth. But recent evidence suggests that there is a high degree of fetal involvement in the timing of birth.

The initial stage of birth is the result of the stimuli from the fetal pituitary. The ACTH released from fetal pituitary stimulates the fetal adrenal gland to release corticosteroids which cross the placental barrier and enter the maternal blood circulation causing a decrease in progesterone production.

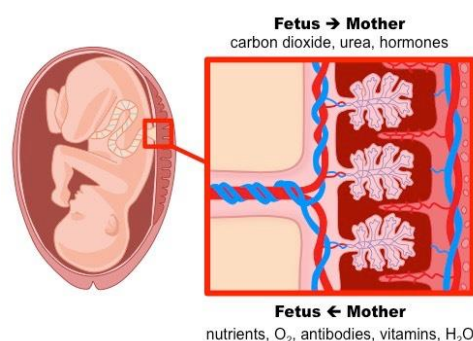


Fig. Placenta structure

The embryonic blood vessels that supply the developing child with nutrients and remove the metabolic wastes are separated from the blood vessels of the mother. Because of this separation, the placenta can selectively filter many types of incoming materials and micro-organisms.

Oxytocin and Labour:

The reduction of progesterone level stimulates the pituitary gland to produce oxytocin hormone. This induces labour pains i.e. contraction of the uterus walls.

The release of oxytocin occurs in "waves" during labour and provides the force to expel the fetus from the uterus.

Delivery:

The cervix dilates and the uterine contractions spread down over the uterus and are strongest from top to bottom, thus, pushing the baby downward leading to the delivery of the baby. The umbilical cord is ligated and baby is released from the mother.

Release of After Birth:

Within 10-45 minutes after birth the uterus contracts and separates the placenta from the wall of the uterus and placenta then passes out through the vagina. This is called after birth.

Bleeding During Delivery:

Bleeding, throughout this period, is controlled by the contraction of smooth muscle fibers which completely surround all uterine blood vessels supplying the placenta. Average loss of blood is about 350 ml.

Test Tube Babies:

If some physiological and physical abnormalities, in reproductive system in any of the two parents then test tube baby is possible.

Parental sperm and ovum is fertilized in vitro outside the female body and then the zygote is implanted back into the mother uterus, placenta establishes and remaining development takes place in the body of the mother leading to normal birth.

Sexually Transmitted Diseases (Std):

Unhealthy Attitudes And Low Moral Values Sometime lead to serious complication. The carrier may transmit this disease to their healthy partners.

1. Gonorrhoea:

Causal Organism:

It is caused by a gram positive bacteria *Neisseria gonorrhoeae*.

Effects:

It mainly affects the mucous membrane of urinogenital tract. New born infants may acquire serious eye infections if they pass through the infected birth canal.

Transmission:

It is highly contagious through sexual contacts.

2. Syphilis:

Causal Organism:

It is caused by a spirochete, *Treponema pallidum*.

Symptoms:

It damages the reproductive organs, eyes bones joints, central nervous system, heart and skin.

Transmission:

Sexual contact is the major source of its spreading.

3. Genital Herpes:

Causal Organisms:

It is caused by it herpes simplex type 2 virus (HSV-2)

Symptoms:

It produces genital soreness and ulcers in the infected areas

Transmission:

It is most frequently transmitted by sexual contact causing infection of the genitalia. In infected pregnant woman, virus can be transmitted to infant during birth, causing damage to eyes and CNS of the infant.

4. AIDS (Acquired Immune Deficiency Syndrome):

Causal Organism:

It is caused by HIV (Human Immunodeficiency)

Symptoms:

Patient loses his power of immunity.

Transmission: Sexual contact is a major source of its spread.

Control:

It is by avoiding sexual contacts with.

Control of Sexually Transmitted Diseases (STD):

The above sexual diseases can be controlled and prevented by avoiding sexual contacts with carrier or diseased person and adopting the hygienic conditions.

The treatment involves medication for a long period except AIDS.