

Brief Idea of Menstrual Cycle & Estrous Cycle

10.4. Menstrual Cycle And Estrous Cycle

The reproductive system of female mammals shows regular cyclic changes known as **sex cycles** (or **reproductive cycles**) throughout their reproductive life except during pregnancy. In each sex cycle, the reproductive organs *e.g.*, ovary, uterus *etc.*, undergo a series of changes that are repeated in the next cycle. Such cyclic behavior of the female reproductive organs is caused by alternate release of FSH and LH from anterior pituitary. Males do not show sex cycles because their pituitary secretes FSH and LH continuously. The sex cycle of primates (*e.g.*, humans, chimpanzee, gorilla *etc.*) is called menstrual cycle whereas in non-primate mammals (*e.g.*, rat, mice, cat, bitch *etc.*), the sex cycle is called **estrous** (or **oestrous**) cycle. The duration of sex cycle (menstrual cycle as well as estrous cycle) varies widely from species to species.

● Menstrual cycle :

Female primates including humans show periodic vaginal bleeding at regular intervals during their reproductive life except in pregnancy. This phenomenon of vaginal bleeding is known as **menstruation** (or **period**). The menstrual bleeding is due to disintegration and shedding of uterine mucosa (endometrium) causing rupture of blood vessels. *Regular repetition of events from the beginning of one menstruation to that of the next is called menstrual cycle.*

In human females, menstruation occurs at an interval of 28 ± 3 days (*i.e.*, approximately one month or four weeks). That means, the **duration of menstrual cycle** is roughly one month. *Menstruation is the external manifestation of menstrual cycle.*

In each menstrual cycle, the ovarian hormones (estrogen and progesterone) secreted under the influence of pituitary gonadotrophins (FSH and LH) cause proliferation of uterine endometrium to prepare a suitable bed for implantation of the zygote in case if the ovum is fertilized. In absence of fertilization, blood levels of these hormones drop suddenly as a result of which the endometrium is disintegrated and shed out causing menstruation. In case of pregnancy (*i.e.*, if ovum is fertilized and zygote is implanted), destruction of endometrium and thus menstruation is prevented by the hormones (HCG, estrogen and progesterone) secreted from chorionic villi and placenta. So, *menstruation* and thus *the menstrual cycle do not occur during pregnancy*.

Menstruation and menstrual cycle are also absent before puberty and after menopause because during these periods, the pituitary does not secrete gonadotrophins.

▲ Phases of menstrual cycle :

Menstrual cycle is usually divided into **three phases**. A brief description of the phases in human menstrual cycle is given below.

[1] **Proliferative phase or Follicular phase**— It begins from the end of menstruation and continues for about 10 days. In this phase, the pituitary secretes FSH which causes maturation of graafian follicle in ovary (hence the name follicular phase) and secretion of estrogen from it. The estrogen inturn causes proliferation and growth of the uterine endometrium (hence the name proliferative phase). At the end of this phase, blood level of estrogen becomes very high which inhibits FSH secretion and causes LH surge (*i.e.*, sudden release of LH) from pituitary. The LH inturn causes ovulation by rupturing the mature graafian follicle.

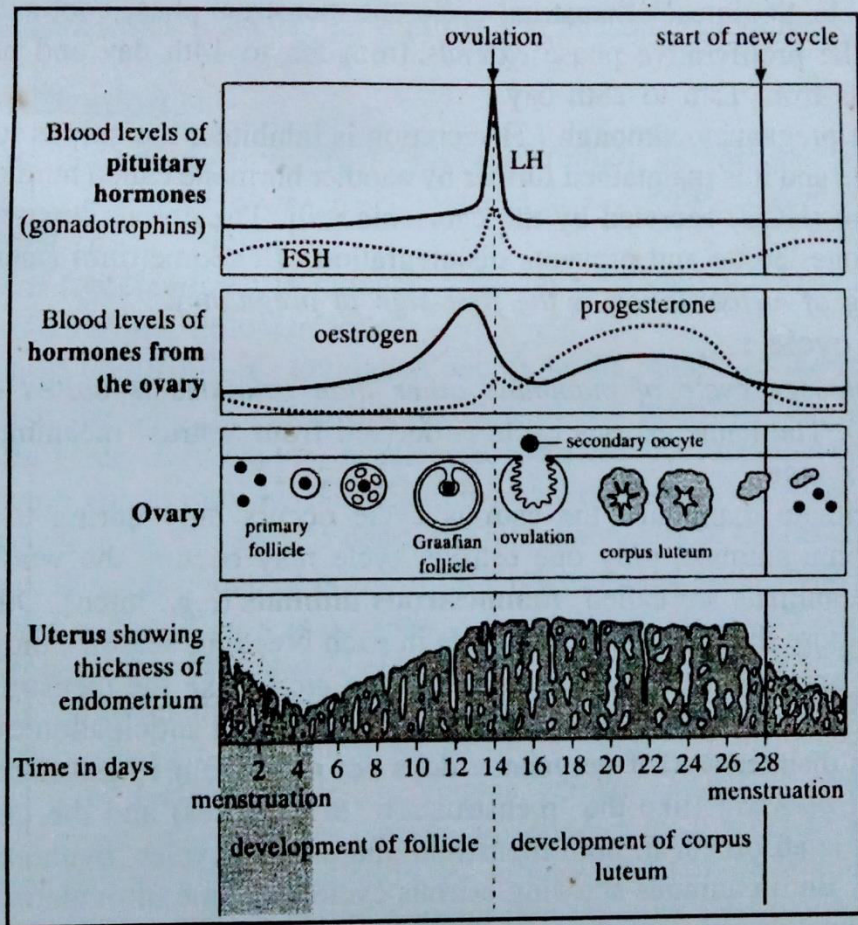


Fig. 10.11 : Correlation between hormonal, ovarian and uterine changes during menstrual cycle.

[2] **Premenstrual phase**— Its duration is about 14 days. It begins after ovulation and extends upto the onset of next menstruation if the ovum is not fertilized. As this phase precedes menstruation, it is called premenstrual phase. During this phase, the pituitary continues to secrete LH for formation and maintenance of corpus luteum. The corpus luteum secretes progesterone which maintains growth of endometrium and prepares it for pregnancy. The endometrial glands become highly developed and secretory. This phase is also called **progestational** (or **progravid**) **phase** (because it prepares the uterus for pregnancy ; gestation=pregnancy, gravid=pregnant) or **luteal phase** (because it is maintained by corpus luteum) or **secretory phase** (because in this phase, the endometrium is highly secretory).

[3] **Menstrual phase or Destructive phase**— It is the phase of vaginal bleeding (menstruation) lasting for about 4 days. At the end of premenstrual phase, blood level of progesterone reaches a peak which inhibits LH secretion from pituitary. As a result of this, the corpus luteum is degenerated causing a sudden drop in progesterone secretion. Thus, being deprived of the hormonal support, the endometrium is disintegrated and sloughed off causing discharge of blood, mucus, ruptured blood vessels *etc.*, through the vagina. So, menstruation is also referred to as '*weeping of uterus*' (as if the uterus sheds bloody tears on being disappointed due to absence of pregnancy). The blood shed in the uterus usually clots but due to presence of an enzyme called **fibrinolysin** (which hydrolyses fibrin) in uterus, the clotted blood is liquefied, and it cannot clot again because fibrinogen is absent in it.

It is to be noted that the 1st day of menstruation is considered as the 1st day of menstrual cycle. So, in each menstrual cycle, the menstrual phase continues from 1st to 4th day, the proliferative phase extends from 5th to 14th day and premenstrual phase extends from 15th to 28th day.

In case of pregnancy, although LH secretion is inhibited, the corpus luteum does not degenerate and it is maintained further by another hormone called human chorionic gonadotrophin (HCG) secreted by the chorionic villi. The corpus luteum continues to secrete progesterone and prevents disintegration of endometrium (menstruation). *Thus, missing of menstruation is the first sign of pregnancy.*

● Estrous cycle :

The female sex cycle of mammals other than primates is called estrous (or estrous cycle). The name estrous cycle is derived from 'estrus' meaning the period of intense sex urge.

In non-primate mammals, the estrous cycle occurs only during the **breeding season**. In some animals, only one estrous cycle may occupy the whole breeding season ; such animals are called '**monoestrous animals**'(e.g., bitch). Other animals show many (more than one) estrous cycles in each breeding season ; they are called '**polyestrous animals**' (e.g., rat, mice, guineapig etc.). Like the menstrual cycle, in estrous cycle also, the uterine endometrium is developed in anticipation of pregnancy and then it is disintegrated if pregnancy does not occur. But in estrous cycle, there is *no vaginal bleeding* (like the 'menstruation' of primates) and the disintegrating endometrium is absorbed. In both menstrual and estrous cycles, ovulation occurs at the midcycle. But in animals showing estrous cycle, the time of ovulation is marked by intense sexual desire of the female ; this is known as **heat period** or **estrus**. Only during this phase, the female animal receives the male *i.e.*, permits copulation. Thus,

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in non-primate mammals, copulation is restricted to a particular period of estrous cycle whereas in menstruating mammals (primates), copulation can occur at any time.

▲ Phases of estrous cycle :

The estrous cycle is divided into following **four phases** that can be detected by examining the vaginal smears.

[1] **Proestrus**— It is comparable to the proliferative phase of menstrual cycle in which estrogen secreted by the maturing follicle causes proliferation of uterine and vaginal epithelium.

[2] **Estrus (Heat period)**— It is the period of sex desire and ovulation caused by high level of estrogen. In each estrus phase several ova are released. In some animals (e.g., cat, rabbit etc.), ovulation does not occur in absence of copulation. Such animals are called **post-copulatory ovulators** or **reflex ovulators** in which the ovulatory LH surge is caused by neural stimuli originating from vagina during copulation and not by high estrogen level.

[3] **Metestrus** — It is the **luteal phase** in which progesterone secreted by corpora lutea maintains the uterine changes. In absence of pregnancy the corpora lutea degenerate causing degeneration of the uterine mucosa. In some species, the corpora lutea remain active for longer periods (even in absence of pregnancy) causing pregnancy-like changes ; it is called **pseudopregnancy**.

[4] **Diestrus and Anestrus**— These are periods of sexual dormancy in between consecutive estrous cycles. **Diestrus** is the interval between end of metestrus and onset of next proestrus whereas **anestrus** is the interval between two breeding seasons. Thus, in monoestrous animals, the diestrus and anestrus are same.