

A.

Cyclic changes in the:

1. CERVIX

thick) is left behind.

CYCLIC CHANGES IN CERVIX

The mucosal lining of cervix (endocervix) also shows certain cyclic changes during sexual cycle.

These are:

During menstruation phase, the mucosa of cervix does not undergo desquamation (shedding off) like that of endometrium.

During proliferative phase (oestrogen phase), the secretions of the mucosal cells of endocervix become thin watery and alkaline. At the time of ovulation, the cervical mucus is thinnest and its elasticity is maximum. It can be stretched like a long, thin elastic thread up to 8–12cm (spinnbarkeit effect). The mucus also produces a characteristic fern-like pattern when a drop of mucus is spread on the glass slide and allowed to dry

This characteristic nature of cervical mucus favours the transport of sperms in the female genital tract and makes the conditions favourable for fertilization.

During secretory phase under the influence of progesterone, cervical secretions decrease in quantity and become thick, tenacious and cellular, and fern pattern is not seen

These changes make a plug and prevent the entry of sperm through cervical canal.  
entry of sperm through cervical canal.

Note. Fern test. The fern pattern of cervical mucus in the proliferative phase and its disappearance in the secretory phase is indicative of ovulatory cycle, whereas persistence of fern pattern throughout the cycle indicates anovulatory cycle.

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2. Vagina

CYCLIC CHANGES IN VAGINA

Vaginal canal is lined by stratified squamous epithelium, which is highly sensitive to oestrogens (oestradiol). Vaginal epithelium undergoes following cyclic changes in the endometrial cycle: In proliferative phase, vaginal epithelium becomes thickened (by adding up more and more layers of epithelium) and cornified.

In secretory phase under the influence of progesterone, vaginal epithelium proliferates and gets infiltrated with leucocytes and cornified.

In secretory phase under the influence of progesterone, vaginal epithelium proliferates and gets infiltrated with leucocytes and the vaginal secretions become thick and viscid.

B.

### Menstrual Cycle

Menstruation (also termed period or bleeding) is the process in a woman of discharging (through the vagina) blood and other materials from the lining of the uterus at about one monthly interval from puberty until menopause (ceasing of regular menstrual cycles), except during pregnancy. This discharging process lasts about 3-5 days. The uterine cycle describes a series of changes that occur to the lining of the uterus, or endometrium, during a typical menstrual cycle.

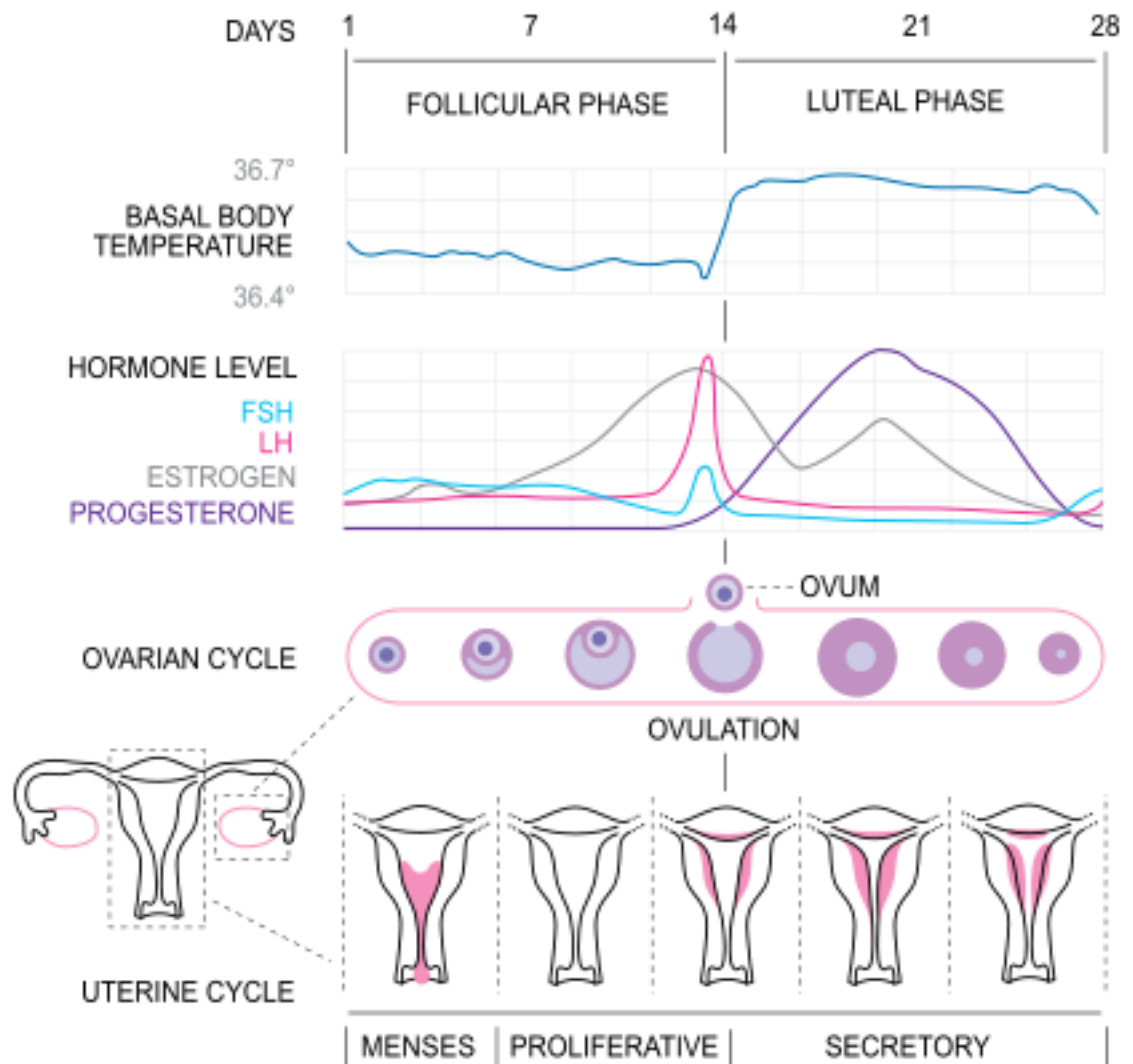
Several changes to the uterine lining (endometrium) occur during the menstrual cycle, also called the uterine cycle. The endometrium is the innermost glandular layer of the uterus. During the menstrual cycle, the endometrium grows to a thick, blood vessel-rich tissue lining, representing an optimal environment for the implantation of a blastocyst upon its arrival in the uterus. Menstrual cycles are counted from the first day of menstrual bleeding and are typically 28 days long.

During menstruation, the body begins to prepare for ovulation again. The levels of estrogen gradually rise, signalling the start of the follicular, or proliferation, phase of the menstrual cycle.

The discharge of blood slows and then stops in response to rising hormone levels and the lining of the uterus thickens, or proliferates. Ovulation is triggered by a surge in luteinizing hormone. The sudden change in hormones at the time of ovulation sometimes causes minor changes in the endometrium and light midcycle blood flow.

After ovulation, under the influence of progesterone, the endometrium changes to a secretory lining in preparation for the potential implantation of an embryo to establish a pregnancy. If a blastocyst implants, then the lining remains as the decidua. This becomes part of the placenta and provides support and protection for the embryo during gestation.

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Implantation does not occur within approximately two weeks, the progesterone-producing corpus luteum in the ovary will recede, causing sharp drops in levels of both progesterone and estrogen. This hormone decrease causes the uterus to shed its lining and the egg in menstruation. The cessation of menstrual cycles at the end of a woman's reproductive period is termed menopause. The average age of menopause in women is 52 years, but it can occur anytime between 45 and 55.

### Phases of the Menstrual Cycle

The menstrual cycle is divided into three stages: follicular phase, ovulation, and the luteal phase.

#### **Follicular Phase**

During the follicular phase (or proliferative phase), follicles in the ovary mature under the control of estradiol. Follicle-stimulating hormone (FSH) is secreted by the anterior pituitary gland beginning in the last few days of the previous menstrual cycle. Levels of FSH peak during the first week of the follicular phase. The rise in FSH recruits tertiary-stage ovarian follicles (antral follicles) for entry into the menstrual cycle.

Follicle-stimulating hormone induces the proliferation of granulosa cells in the developing follicles and the expression of luteinizing hormone (LH) receptors on these cells. Under the influence of FSH, granulosa cells begin estrogen secretion. This increased level of estrogen stimulates production of gonadotropin-releasing hormone (GnRH), which increases production of LH. LH induces androgen synthesis by theca cells, stimulates proliferation and differentiation, and increases LH receptor expression on granulosa cells.

Throughout the entire follicular phase, rising estrogen levels in the blood stimulate growth of the endometrium and myometrium of the uterus. This also causes endometrial cells to produce receptors for progesterone, which helps prime the endometrium to the late proliferative phase and the luteal phase. Two or three days before LH levels begin to increase, one or occasionally two of the recruited follicles emerge as dominant. Many endocrinologists believe that the estrogen secretion of the dominant follicle lowers the levels of LH and FSH, leading to the atresia (death) of most of the other recruited follicles. Estrogen levels will continue to increase for several days. High estrogen levels initiate the formation of a new layer of endometrium in the uterus, the proliferative endometrium. Crypts in the cervix are stimulated to produce fertile cervical mucus that reduces the acidity of the vagina, creating a more hospitable environment for sperm. In addition, basal body temperature may lower slightly under the influence of high estrogen levels.

### **Ovulation**

Estrogen levels are highest right before the LH surge begins. The short-term drop in steroid hormones between the beginning of the LH surge and ovulation may cause mid-cycle spotting or bleeding. Under the influence of the preovulatory LH surge, the first meiotic division of the oocytes is completed. The surge also initiates luteinization of theca and granulosa cells. Ovulation normally occurs 30 ( $\pm$  2) hours after the beginning of the LH surge.

Ovulation is the process in a female's menstrual cycle by which a mature ovarian follicle ruptures and discharges an ovum (oocyte). The time immediately surrounding ovulation is referred to as the ovulatory phase or the periovulatory period. In the preovulatory phase of the menstrual cycle, the ovarian follicle undergoes cumulus expansion stimulated by FSH. The ovum then leaves the follicle through the formed stigma. Ovulation is triggered by a spike in the amount of FSH and LH released from the pituitary gland.

### **Luteal Phase**

The luteal phase begins with the formation of the corpus luteum stimulated by FSH and LH and ends in either pregnancy or luteolysis. The main hormone associated with this stage is progesterone, which is produced by the growing corpus luteum and is significantly higher during the luteal phase than other phases of the cycle. Progesterone plays a vital role in making the endometrium receptive to implantation of the blastocyst and supportive of the early pregnancy. It also raises the woman's basal body temperature.

Several days after ovulation, the increasing amount of estrogen produced by the corpus luteum may cause one or two days of fertile cervical mucus, lower basal body temperatures, or both. This is known as a secondary estrogen surge. The hormones produced by the corpus luteum suppress production of the FSH and LH, which leads to its atrophy. The death of the corpus luteum results in falling levels of progesterone and estrogen, which triggers the end of the luteal phase. Increased levels of FSH start recruiting follicles for the next cycle.

Alternatively, the loss of the corpus luteum can be prevented by implantation of an embryo: after implantation, human embryos produce human chorionic gonadotropin (hCG). Human chorionic gonadotropin is structurally similar to LH and can preserve the corpus luteum. Because the hormone is unique to the embryo, most pregnancy tests look for the presence of hCG. If implantation occurs, the corpus luteum will continue to produce progesterone (and maintain high basal body temperatures) for eight to 12 weeks, after which the placenta takes over this function.