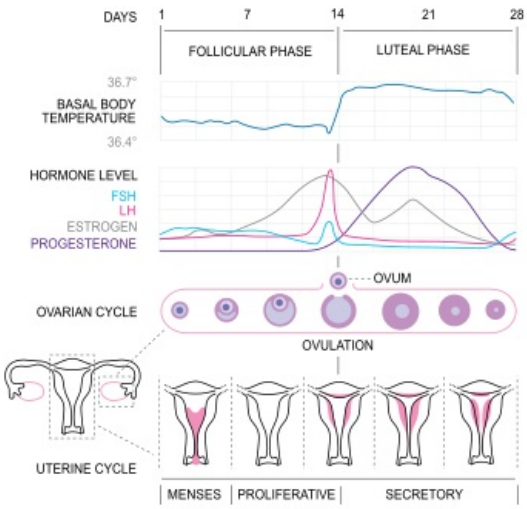
Menstrual cycle



In a broader sense, the term *menstrual cycle* is used for regularly recurring changes in the *whole organism of a woman*. In the narrower sense of the word, it is used for the cyclic changes of the *endometrium*, which have a direct relationship with the ovarian cycle. Their purpose is to prepare the endometrium for the implantation of a fertilized egg and its further development.

The physiological menstrual cycle is called *eumenorrhea* and its average length is 28 days (with a 3-5 day variation). It runs from puberty to Climacterium. In practice (clinically), the first day of menstrual bleeding is considered the beginning of the cycle. However, from the point of view of hormonal changes, the beginning of the cycle is associated with a rise in the level of FSH, which precedes the actual menstrual bleeding by 2-3 days. The absence of a menstrual cycle is referred to as *amenorrhea*[1].

Changes to the endometrium (except the cervix) occur as a result of the action of ovarian hormones. Their formation and release are controlled from a higher level (hypothalamus-pituitary axis). In recent years, biochemical and morphological changes that take place in the ovary are considered to be the most fundamental for cycle timing. The hypothalamus participates in the regulation of the cycle through the pulsatile secretion of GnRH. This hormone enables the secretion of gonadotropins in the pituitary gland (LH + FSH), which is also under ovarian control (estrogens, inhibin, activin and follistatin).

Menstrual Cycle Phases

The menstrual cycle begins with the proliferative phase, but in practice we indicate the beginning of the menstrual cycle as the first day of the last menstrual phase.

0. Premenstrual phase (ischemic)

28th day of the cycle, lasts a few hours for a maximum of one day. It occurs when the fertilized egg has not fertilized. The mucosal tissue is infiltrated by lymphocytes and leukocytes. There is a several-hour contraction of the smooth muscle of the spiral arterioles in the endometrium (a decrease in ovarian hormones), resulting in ischemia and necrosis of the stratum functionale (the stratum basale has an independent vascular supply). As a result of degenerative changes in the glands and blood vessels, cells break down (tissue enzymes and enzymes released by leukocytes are used). The contraction of the supply arterioles relaxes after a few hours and sudden congestion occurs. The walls of the vessels lying in the ischemic area have broken so much that blood spurts into the mucous membrane. The entire necrobiotic layer in the stratum functionale undergoes autolytic changes and is shed by menstrual bleeding. Myometrium contraction and vasoconstriction of the supply arteries in the myometrium are involved in stopping menstrual bleeding. Menstrual blood is a mixture of arterial and venous blood and does not clot due to enzymes from the broken down mucosa.

1. Menstrual phase (desquamation)

Lasts 1-4 days. The superficial necrotic part of the *stratum functionale* **mucosa is separated and washed away** within 48 hours by menstrual bleeding (menses, menstruation). The contraction of the uterus also helps expulsion. In an anovulatory cycle (see ovarian cycle), this bleeding should properly be called pseudomenstruation. The total amount of blood loss should not exceed 1 ml per 1 kg of the woman's weight. Usually 35-80 ml is given.

2. Regenerative phase

4. and the 5th day of the cycle. It involves **reepithelialization of the exposed surface** of the uterine lumen. Epithelial cells grow from the epithelium of the uterine glands in the *stratum basale* of the endometrium.

3. Proliferative (follicular) phase

5.-14. cycle day. It takes place under the influence of estrogens from the growing and maturing ovarian follicle. The stratum functionale of the endometrium is renewed by *hyperplasia* (cell division) and is perfused with blood. Epithelium of glands and tissue cells proliferate, intercellular mass and tissue fibers multiply.

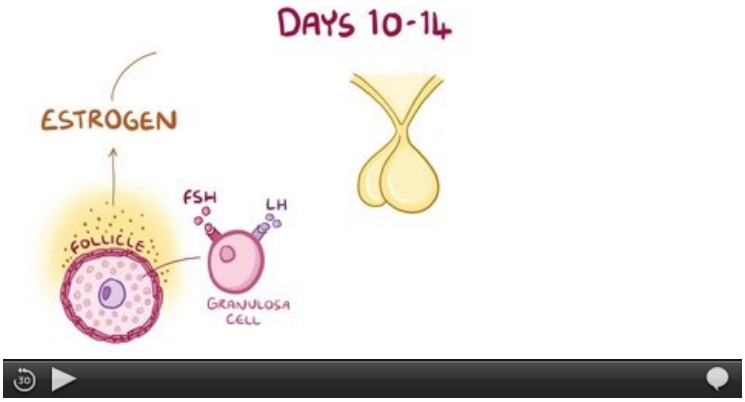
4. Secretory phase (luteal)

Day 15-27 of cycle. It takes place under the influence of corpus luteum hormones (progesterone). The mucous membrane of the stratum functionale increases mainly by *hypertrophy* (enlargement of cells), by *increased vascularization* and by *stromal edema*. Endometrial cells accumulate glycogen and lipids. The glands enlarge and

fill with a mucus-like secretion that contains mucin, glycogen, and lipids. The glands twist helically (except for the basal and apical parts). Zona functionalis can be divided according to the arrangement of glands and stroma into:

- **stratum spongiosum** - deeper and thinner (glands show changes) layer;
- **stratum compactum** - a denser and thinner surface layer (the apical ends of the glands are narrower and run straight).

At the end of the secretion phase, optimal conditions for nidation are created. If fertilization does not occur, the corpus luteum disappears and thus the production of progesterone, the *pseudodecidual transformation* of the stroma, and this phase ends with the preparation for the separation of the mucous membrane.



Video in English.

Links

Related Articles

- Ovarian cycle
- Hypothalamo-pituitary system
- Cyclic bleeding disorders

External links

- Menstrual cycle (Czech Wikipedia)
- Menstrual cycle (English Wikipedia)
- Histology and embryology 3.LF (http://histologie.lf3.cuni.cz/histologie/materialy/doc/skripta.pdf)
- Menstrual cycle - Youtube video (https://www.youtube.com/watch?v=QfjiOZ-iCeA)

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- GANONG, William F. *Review of Medical Physiology.* 20. edition. Prague : Galen, 2005. 890 pp. ISBN 80-7262-311-7.

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