

Menstrual Cycle, physiology of

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face= Arial **Physiology of the Menstrual Cycle**

Menstrual flow normally begins between the ages 8 and 16 years (average age of menarche is 13 years). Menstruation usually stops by age 52 years (normal range 45 to 55 years). The median cycle length between periods changes with age, being 28.87 days at age 20 and 26.8 days at age 40. Cycle length is the most unpredictable in the years following menarche and just before menopause.

Cycle lengths less than 24 days are considered polymenorrhea. Cycle lengths more than 35 days are considered oligomenorrhea. Normal menstrual flow ranges from 3 to 7 days. Blood loss is usually 80 ml or less. Excessive menstrual blood loss is called menorrhagia.

Diagrammatic representation of the menstrual cycle. From [Ryan](#)

The hypothalamus releases gonadotropin-releasing hormone (GnRH) in a pulsatile fashion. Decreased GnRH pulse frequency results in oligomenorrhea or amenorrhea. Increased pulse frequency is found in polycystic ovary syndrome. Pulses of GnRH stimulate the pituitary to release luteinizing hormone (LH) and follicle-stimulating hormone (FSH) in a pulsatile fashion.

Estradiol from the ovary inhibits pituitary release of FSH and LH by negative feedback. In the ovary, oocytes are resting until stimulated by the LH surge to enter meiosis. Estradiol produced by the oocyte follicle causes the endometrium of the uterus to proliferate. Estradiol stimulates vascular growth in the endometrium.

Proliferative endometrium early in menstrual cycle. Glands are straight (magnification top 150x; bottom 400x). Reprinted by permission from the American Society for Reproductive Medicine. From Noyes RW et al: Dating the endometrial biopsy, *Fertil Steril* 1:3-20, 1950.

Proliferative endometrium just prior to ovulation. Glands are now tortuous (magnification top 150x; bottom 400x). Reprinted by permission from the American Society for Reproductive Medicine. From Noyes RW et al: Dating the endometrial biopsy, *Fertil Steril* 1:3-20, 1950.

After ovulation the ovarian follicle reorganizes into a corpus luteum. The corpus luteum produces progesterone. Progesterone induces a secretory change in the proliferating endometrium. The endometrial vasculature organizes into tortuous spirals. In the absence of pregnancy the corpus luteum becomes less sensitive to LH. Estrogen and progesterone levels fall. Prostaglandin F2a, found in the endometrium, causes vasoconstriction and myometrial contraction. The spiral arterioles vasoconstrict. Ischemia of the endometrium results in tissue breakdown and bleeding. Postovulatory endometrial changes are very predictable. The first day of menstrual bleeding is designated as day 1 of the menstrual cycle. The appearance of the endometrium on biopsy correlates with the day of the menstrual cycle to within 2 days.

[Click to enlarge.](#) Day 17 of the cycle. Three days after ovulation, the nuclei of the glands are in the center of the cells with cytoplasm

above and vacuoles below (magnification top 150x; bottom 400x). Reprinted by permission from the American Society for Reproductive Medicine. From Noyes RW et al: Dating the endometrial biopsy, *Fertil Steril* 1:3-20, 1950.

[Click to enlarge.](#) Day 25 of the cycle. Eleven days after ovulation, the glands are very tortuous with deep serrations in their walls (saw tooth glands). Round cells infiltrate the stroma (magnification top 150x; bottom 400x). Reprinted by permission from the American Society for Reproductive Medicine. From Noyes RW et al: Dating the endometrial biopsy, *Fertil Steril* 1:3-20, 1950.

[Click to enlarge.](#) Day 27 of the cycle. In the absence of a pregnancy, the endometrium degenerates. White cells infiltrate the stroma (magnification top 150x; bottom 400x). Reprinted by permission from the American Society for Reproductive Medicine. From Noyes RW et al: Dating the endometrial biopsy, *Fertil Steril* 1:3-20, 1950.

If ovulation does not occur, progesterone is not produced. The endometrium proliferates unchecked. At some point, the endometrium cannot be maintained and starts to slough. Anovulatory bleeding occurs unpredictably and varies in amount. Anovulatory bleeding can be quite heavy. ([Ryan](#), [Mishell](#))