

The Menstrual Cycle: Female Anatomy and Physiology

The female reproductive system is a wonderfully complex system involving continuous communication between the brain centers and the ovary. Hormones secreted by the hypothalamus, the pituitary, and the ovary are the messengers which regulate the monthly cycle.

The Hypothalamus and the Pituitary

The hypothalamus is located centrally in the brain and communicates by way of an exchange of blood with the pituitary gland. Several neuroendocrine agents, or hormones, are produced by the hypothalamus. The one which is important for reproduction is called gonadotropin releasing hormone or better known as GnRH. It is released in a pulsatile fashion every 60 to 120 minutes.

GnRH stimulates or causes the pituitary gland to produce the hormone responsible for starting follicle (egg) development and causing the level of estrogen (the primary female hormone) to rise. This hormone is follicle stimulating hormone (FSH). Leutinizing hormone (LH), the other pituitary hormone, aids in egg development and maturation, and causes ovulation.

The Ovary

The main function of the ovaries is the production of eggs and hormones. At birth, the ovaries contain thousands of immature eggs. No new eggs will be developed. These eggs are constantly undergoing a process of development and loss. Most will die without reaching maturity. This process of egg loss occurs at all times, including before birth, before puberty, and while on birth control pills. It is a constant process of oocyte (egg) depletion.

As the levels of FSH and LH in the blood increase with puberty, the eggs begin to mature and a collection of fluid (the follicle) begins to develop around each. The first day of menses is identified as cycle day one. Estrogen is at a low point. Therefore, the pituitary secretes FSH and LH, a process that actually begins before the onset of your menses. These hormones in turn stimulate the growth of several ovarian follicles (each containing one egg). The number of follicles in the "cohort" of developing follicles each month is unique to each individual. One follicle will soon begin to grow faster than others. This is called the dominant follicle. As the follicle grows, blood levels of estrogen rise significantly by cycle day seven. This increase in estrogen begins to inhibit the secretion of FSH. The fall in FSH allows the withering away of smaller follicles. They are, in effect, "starved" for FSH.

Ovulation

When the level of estrogen is sufficiently high, it produces a sudden release of LH, usually around day 13 of the cycle. This LH peak (surge) triggers a complex set of events within the follicles that result in the final maturation of the egg and follicular rupture with egg extrusion. The rupture, called ovulation, takes place 28 to 36 hours after the onset of the LH surge and 10 to 12 hours after LH reaches its peak. The cells in the ovarian follicle that are left behind after ovulation undergo a transformation and become the so-called corpus luteum. In addition to estrogen, they now produce high amounts of progesterone to prepare the lining of the uterus for implantation.

The Luteal Phase

The luteal phase, or second half of the menstrual cycle, begins with ovulation and lasts approximately 14 days (typically 12 to 15 days). During this period, changes occur which will support the fertilized egg (embryo) should pregnancy result. The hormone responsible for these changes is progesterone and it is manufactured by the corpus luteum. Under the influence of progesterone, the uterus (womb) begins to change its character, creating a highly vascularized (blood vessel enriched) bed for a fertilized egg. If a pregnancy occurs, the corpus luteum produces progesterone until about 10 weeks gestation. Otherwise, if no embryo implants, the circulating levels of hormone decline with the degeneration of the corpus luteum, the lining of the uterus (endometrium) degenerates and bleeding results (menses).

The Uterus

The lining (endometrium) of the uterus prepares each month for the implantation of an embryo. This preparation occurs under the influence of estrogen and progesterone from the ovary. If no pregnancy develops, the endometrium is shed as a menstrual period, about 14 days after ovulation.

This information is for educational purposes only and is not intended to replace the advice of your physician or health care provider. We encourage you to discuss with your physician any questions and concerns you may have.