

Female Reproductive Cycle

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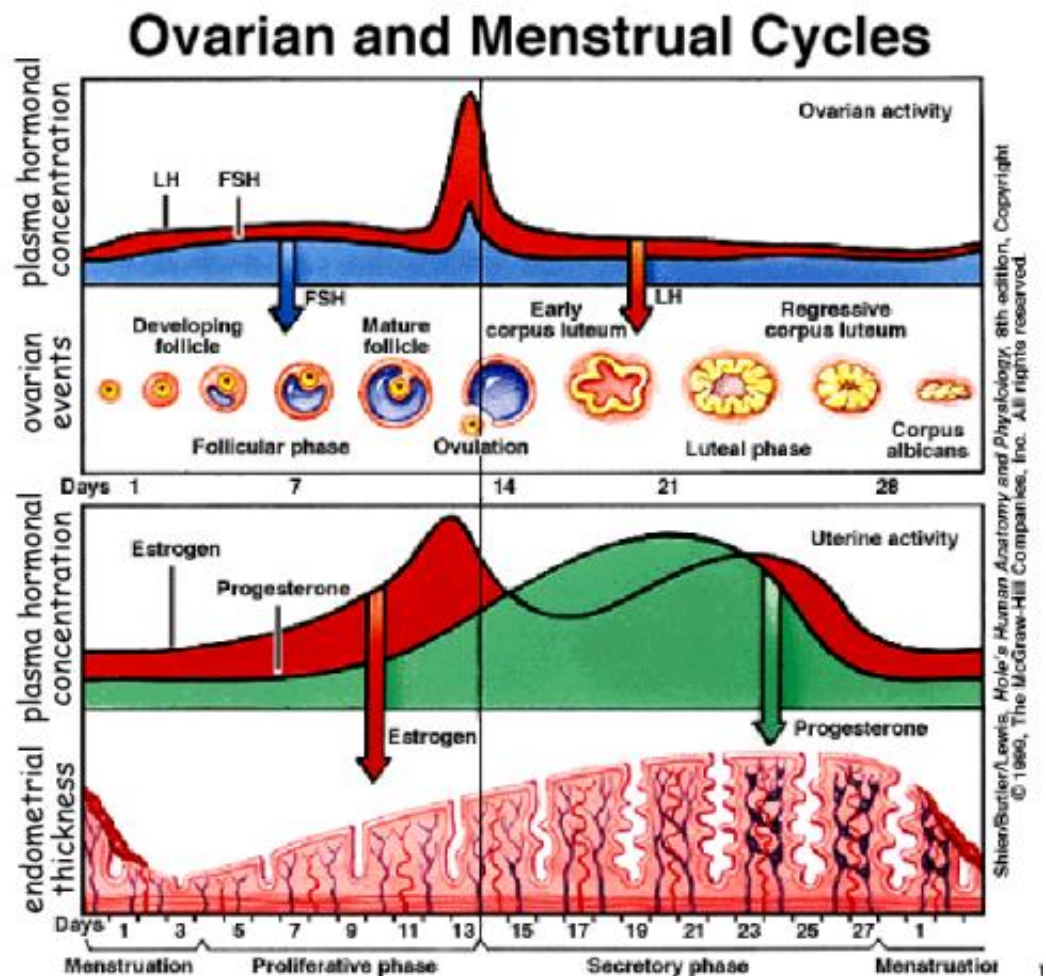
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Female Reproductive Syst

The female reproductive system undergoes cyclical events. These events all center on releasing one ovum per month and providing an environment in which, if the ovum becomes a zygote, the zygote can grow into an embryo and then a fetus. A detailed description of the release of the ovum is provided on the ovulation web page. The cyclical nature of these events is caused by cyclical hormonal changes. Therefore, in order to understand what happens each month in a woman's body, one must understand the hormones involved. Some detail about the hormones involved is provided on a linked page.

The figure below from your book describes all of the major changes that occur over one cycle of the female reproductive system. The cycle is "typically" 28 days long, and this figure shows the 28 days across the X axis (one week at a time, labelled at the center of the figure).

What happens during the month? Well, first of all, a hormonal signal is generated from the brain. Remember, it is the hypothalamus (via GnRH release) that triggers the anterior pituitary to release the gonadotropins FSH and LH. The blue in the top drawing represents FSH (follicle-stimulating hormone), and the blue arrow is only to indicate that FSH works to stimulate the maturation of the follicle. The red in the top drawing represents LH (luteinizing hormone), and the red arrow is only to indicate that LH works to stimulate the corpus luteum. The top half of this figure, then, shows what is going on with FSH & LH levels over the entire month, and what, as a result, is happening with the maturation of the follicle (containing the future-ovum). All of this relates to ovum



release. Now let's move on to getting the body ready for zygote implantation...

The bottom half of the figure shows what is going on with the female reproductive hormone levels (estrogen and progesterone) in the upper section, and what is going on with the lining of the uterus in the lower section. The red in the upper section represents estrogen levels, and the red arrow indicates that the increasing estrogen levels lead to a thickening of the endometrium. The green in the upper section represents progesterone levels, and the green arrow indicates that the *decreasing* progesterone levels cause the atrophy of the thick endometrium so that it becomes thin again. The female reproductive hormones (a.k.a., **estrogens**) are regulated by the gonadotropins, and, in turn, the gonadotropins are regulated via negative feedback from the estrogens. So, FSH & LH stimulate estrogen and progesterone secretion, but then when the levels of estrogen and progesterone get high enough, they inhibit FSH & LH synthesis.

Here are the steps through the cycle:

- ☀ GnRH is released from the hypothalamus (in pulses, somewhat continuously)
- ☀ FSH & LH are released from the anterior pituitary.
- ☀ FSH causes the follicle to develop... as it develops, the follicle secretes estrogen (and some progesterone).
 - ✱ Estrogen causes the thickening of the endometrium to begin.
- ☀ The anterior pituitary releases a surge of stored LH (from more GnRH stimulation)
- ☀ Ovulation (in response to LH) occurs, and the future-ovum enters the uterine tubes
- ☀ The remnants of the follicle remain in the ovary, and are now called the **corpus luteum**.
- ☀ The corpus luteum secretes lots of progesterone (and some estrogen).
 - ✱ Progesterone causes the thickening of the endometrium to continue (and it makes it more vascular and glandular)
 - ✱ The high levels of progesterone and estrogen inhibit production of FSH & LH (so no other follicles develop).
- ☀ The corpus luteum degenerates into the **corpus albicans**, and release of estrogens decreases. (*Note: this only happens if the ovum is NOT fertilized*)
 - ✱ Decline in estrogens causes the sloughing off of the endometrium. This sloughing off is the **menses** (or menstrual flow).
 - ✱ Decline in estrogens releases the inhibition of the anterior pituitary release of gonadotropins, and FSH and LH can be made again.

Take the time to put these steps together with the graph. Have them all make some sense to you. I think the only really confusing part is understanding hormonal levels. To get this under your belt, keep in mind that the negative feedback provided by the estrogens on the anterior pituitary only causes the anterior pituitary to not be able to make more gonadotropins. However, imagine that the anterior pituitary has plenty of gonadotropins... as GnRH works on the anterior pituitary, only some of the total amount of its gonadotropins are released. Therefore, when the level of the estrogens rise, the supply of gonadotropins will merely continue to decrement since it cannot be re-synthesized. Also, this negative

feedback only works to prevent synthesis of gonadotropins if the levels of estrogens are high enough-- this only happens toward the end of the second week of the cycle.

Menopause

How many times can the ovaries go through this cycle? How many times can they cyclically produce hormone, release the secondary oocyte, produce more hormone, and deal with a corpus albicans? It turns out that the ovaries are limited in this ability. The ovaries age, and then they can no longer respond to the gonadotropins. That means that the ovaries will no longer be producing the hormones that they used to produce (although other tissues can still make estrogens), and a female body ends up undergoing some changes. These are described a bit more in your book.

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