

The Human Menstrual Cycle

Pre-Lab Discussion

The *menstrual cycle* is the hormone-controlled reproductive cycle of human females. It involves the periodic development and release of an egg and the periodic shedding of the uterine lining. The menstrual cycle involves interactions of the hypothalamus, pituitary, ovary, and uterus. The cycles usually occur between puberty and menopause. The cycle may be interrupted by pregnancy, illness, or other factors. The menstrual cycle is about 28 days long, but it varies from one female to another.

Each egg produced by the female matures inside a *follicle*, or egg sac, near the surface of the ovary. When the egg is fully mature, the follicle bursts and the egg is released into a Fallopian tube, which leads to the uterus. An unfertilized egg will pass from the female's body within a short time. If this occurs, the lining of the uterus, which has been prepared for the implantation of a fertilized egg, deteriorates and also passes out of the body. The process by which blood and uterine cells are shed through the vagina is called *menstruation*. Menstruation is one phase of the four-phase menstrual cycle.

In this investigation, you will examine the changes that occur during the different phases of the menstrual cycle.

Problem

What changes occur within the body of a human female during the menstrual cycle?

Materials (per student)

Metric ruler
Colored pencils

Procedure

Part A. The Follicle Phase

1. Many egg cells are located within the ovary of a human female. Each egg is contained within a structure called a follicle. Under the influence of follicle-stimulating hormone, or FSH, the follicle matures within the ovary. The amount of FSH in the bloodstream influences the growth and development of the maturing follicle. Figure 1 shows the various stages of a follicle's maturation. Notice that an immature follicle is much smaller than a mature follicle.

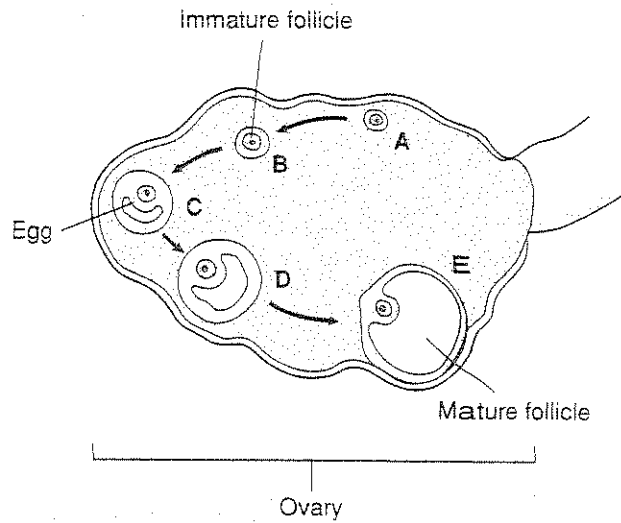


Figure 1

2. Figure 2 shows the concentration of FSH in the bloodstream of an average human female throughout the 28-day menstrual cycle. On Graph 1, prepare a line graph of the data in Figure 2. In the boxes above Graph 1, make drawings of the various stages of follicle maturation. The drawings should match the lettered stages shown in Figure 1.

Amount of FSH in Bloodstream (units per milliliter)			
Day	FSH	Day	FSH
1	9	15	9
2	11	16	8
3	13	17	8
4	14	18	8
5	15	19	8
6	14	20	7
7	14	21	7
8	15	22	6
9	13	23	5
10	11	24	5
11	9	25	6
12	18	26	7
13	13	27	7
14	9	28	8

Figure 2

3. Answer questions 1 through 4 in Observations.

Part B. The Luteal Phase

- Once a follicle is mature, it bursts open and the egg is released. This process is called ovulation. The egg passes into the Fallopian tube where it may or may not be fertilized. Once the mature follicle loses its egg, it forms a body within the ovary called the corpus luteum. Figure 3 shows the changes that occur within the corpus luteum during the menstrual cycle. After maturation, the corpus luteum begins to break apart and disappear. A hormone called luteinizing hormone, or LH, is responsible for causing changes in the corpus luteum.

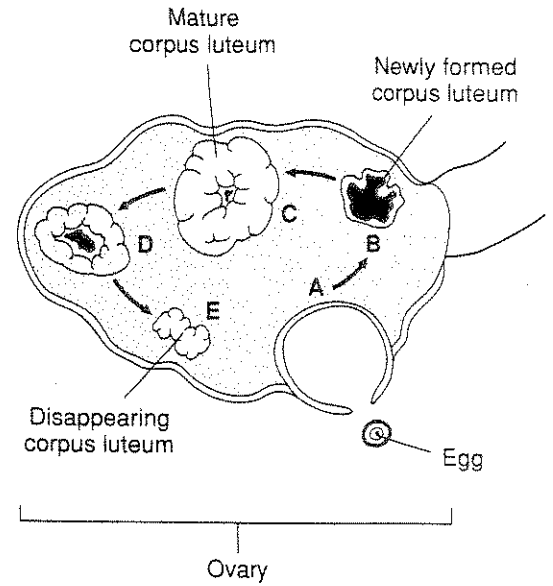


Figure 3

- Figure 4 shows the concentration of LH in the bloodstream of an average human female during the 28-day menstrual cycle. On Graph 2, prepare a line graph of the data shown in Figure 4. In the boxes above Graph 2, make drawings of the various stages of corpus luteum maturation. The drawings should match the lettered stages shown in Figure 3.

Amount of LH in Bloodstream (units per milliliter)			
Day	LH	Day	LH
1	9	15	30
2	12	16	14
3	16	17	10
4	18	18	9
5	19	19	7
6	16	20	5
7	12	21	3
8	19	22	3
9	15	23	2
10	16	24	3
11	20	25	3
12	30	26	4
13	75	27	4
14	58	28	4

Figure 4

3. Answer questions 5 through 8 in Observations.

Part C. Uterine Changes During the Menstrual Cycle

1. As the follicle and luteal phases of the menstrual cycle occur, a series of changes occurs in the uterus. Through rapid cell division, the lining of the uterine walls becomes very thick. At one point in the menstrual cycle, the uterus lining ceases to thicken and begins to break apart. This loss of the uterine lining through the vagina is called menstruation. See Figure 5.

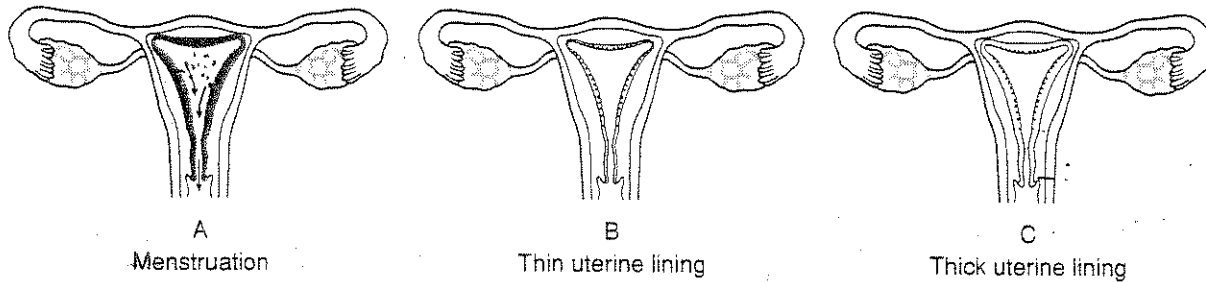


Figure 5

2. Two hormones that are responsible for the building up of the uterine lining are estrogen and progesterone. Figure 6 shows the amounts of estrogen and progesterone found in the bloodstream of an average human female during the 28-day menstrual cycle. On Graph 3, prepare line graphs of the data in Figure 6. Use a different colored pencil to construct each of the line graphs. In the squares shown above Graph 3, make drawings of the various stages of uterine thickness. The drawings should match the lettered stages shown in Figure 5.

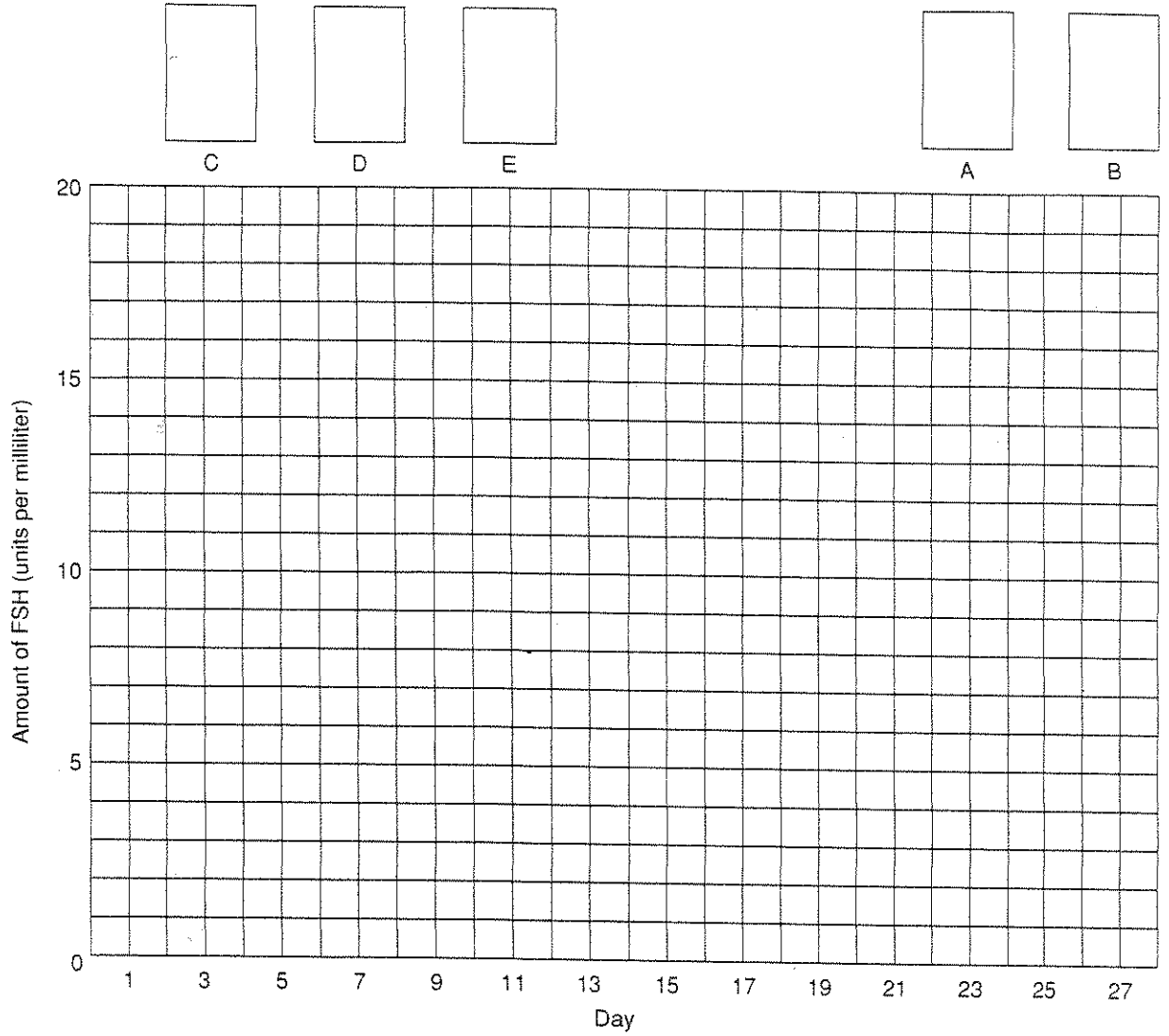
Amount of Estrogen and Progesterone in Bloodstream (units per milliliter)					
Day	Estrogen	Progesterone	Day	Estrogen	Progesterone
1	20	6	15	180	23
2	20	8	16	150	37
3	25	10	17	120	58
4	25	10	18	100	83
5	30	10	19	50	104
6	80	10	20	30	120
7	130	12	21	25	120
8	140	12	22	25	118
9	180	13	23	25	103
10	200	15	24	25	72
11	220	15	25	30	40
12	230	16	26	30	30
13	220	18	27	25	20
14	200	20	28	25	18

Figure 6

3. Answer questions 9 through 11 in Observations.

Observations

Graph 1



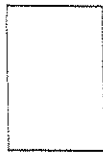
Graph 2



E



A



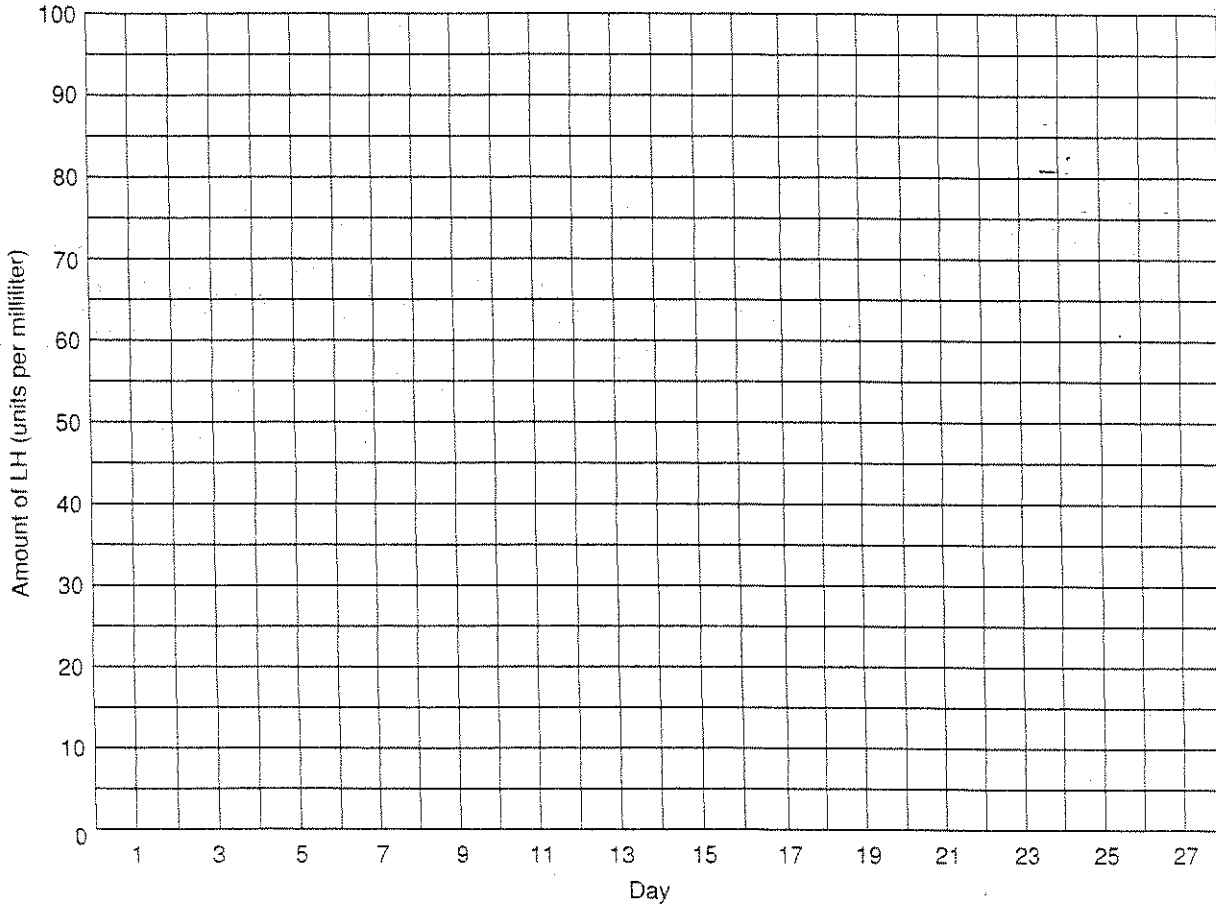
B



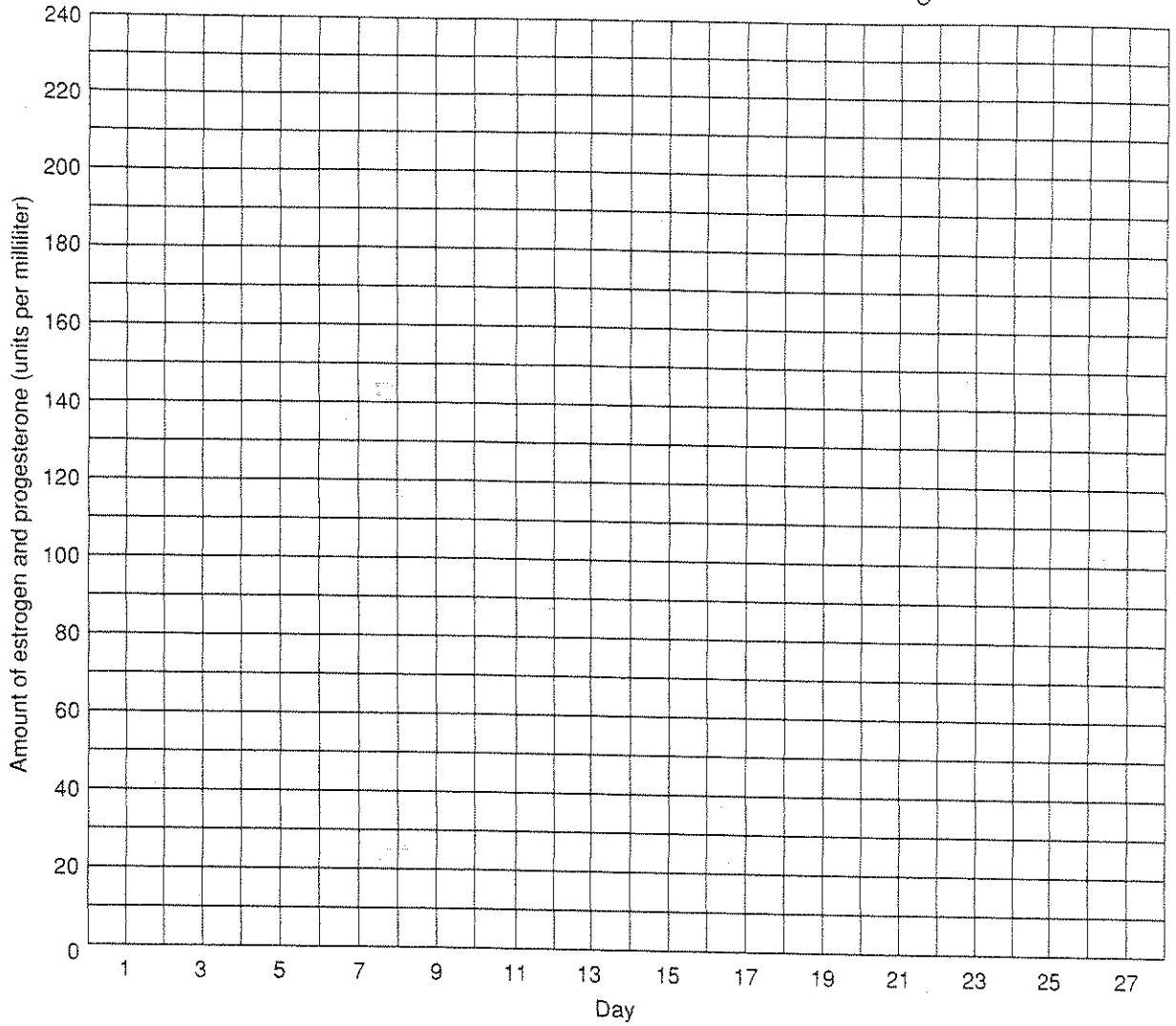
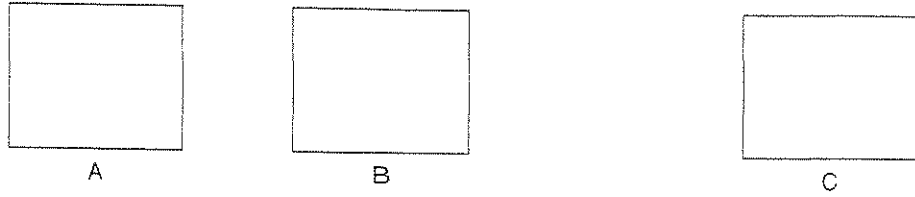
C



D



Graph 3



1. Between days 25 and 12 of the menstrual cycle, what happens to the amount of FSH produced by the body of an average human female? _____

2. What happens to the follicle between days 25 and 12 of the menstrual cycle? _____

3. During which days of the menstrual cycle is the level of FSH at its lowest in the bloodstream?

4. About how long is the follicle phase of the menstrual cycle? _____

5. On which day of the menstrual cycle is the production of LH the greatest?

6. What event occurs immediately after this increased production of LH?

7. What happens to the corpus luteum during days 15 through 24 of the menstrual cycle?

8. a. During which days of the menstrual cycle is the production of LH the lowest?

b. What is happening to the corpus luteum at this time? _____

9. a. What happens to the amount of estrogen produced by the body during days 6 to 12 of the menstrual cycle? _____

b. What is occurring to the uterus during this time? _____

10. a. What happens to the amount of progesterone produced by the body during days 13 to 23 of the menstrual cycle? _____

b. What is occurring to the uterus during this time? _____

11. a. During which days of the menstrual cycle are the levels of both estrogen and progesterone at their lowest? _____

b. What event is occurring at this time? _____

Analysis and Conclusions

1. How is the name follicle-stimulating hormone appropriate for its function?

2. How is the name luteinizing hormone appropriate for its function?

3. Based on your observations, do you think estrogen and progesterone both cause similar changes in the uterus? Explain your answer. _____

4. What events occur during the follicle phase of the menstrual cycle?

5. What events occur during the luteal phase of the menstrual cycle?

Critical Thinking and Application

1. Why are the events described in this investigation referred to as a cycle?

2. The word "menstrual" comes from the Latin word *mensis*, meaning "month." How is the name appropriate for this cycle of the human female reproductive system?

3. If a female did not produce sufficient quantities of FSH and LH, how would her ability to have children be affected? _____

Going Further

Omit 7

1. A comparable cycle involving a periodic growth and loss of uterine cells occurs in mammals other than primates, but little or no blood is lost. The shedding of cells is called estrus, and the cycle is called the estrous cycle. Use reference materials to investigate the estrous cycles of common mammals such as dogs and cats.
2. Women commonly experience a variety of pains, discomforts, and/or emotional disturbances before or during menstruation. In some women, the premenstrual period may be characterized by irritability, sluggishness, or deep depression. Use reference materials to research other symptoms of Premenstrual Syndrome (PMS) and some of the ways in which these symptoms can be medically treated.