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REVIEW SHEET
exercise
43

Physiology of Reproduction: Gametogenesis and the Female Cycles

Meiosis

1. The following statements refer to events occurring during mitosis and/or meiosis. For each statement, decide if the event occurs in (a) mitosis only, (b) meiosis only, or (c) both mitosis and meiosis.

c 1. dyads are visible

b 2. tetrads are visible

a 3. product is two diploid daughter cells

b 4. product is four haploid daughter cells

c 5. involves the phases prophase, metaphase, anaphase, and telophase

a 6. occurs throughout the body

b 7. occurs only in the ovaries and testes

a 8. provides cells for growth and repair

b 9. homologues synapse and chiasmata are seen

b 10. daughter cells are quantitatively and qualitatively different from the mother cell

a 11. daughter cells are genetically identical to the mother cell

c 12. chromosomes are replicated before the division process begins

b 13. provides cells for replication of the species

b 14. consists of two consecutive nuclear divisions, without chromosomal replication occurring before the second division

2. Describe the process of synapsis. *The homologous chromosomes become closely aligned along their entire length.*

3. How does crossover introduce variability in the daughter cells? *Where crossovers occur, chromosome breakage occurs and parts are exchanged. This results in chromosomes with different parental contributions.*

4. Define *homologous chromosomes*. *Chromosomes that carry genes for the same traits. (One = paternal chromosome, the other = maternal chromosome.)*

Spermatogenesis

5. The cell types seen in the seminiferous tubules are listed in the key. Match the correct cell type(s) with the descriptions given below.

Key:
a. primary spermatocyte
b. secondary spermatocyte
c. spermatogonium
d. sustentacular cell
e. spermatid
f. sperm

c 1. primitive stem cell

b, e, f 2. haploid

d 3. provides nutrients to developing sperm

e 4. products of meiosis II

f 5. product of spermiogenesis

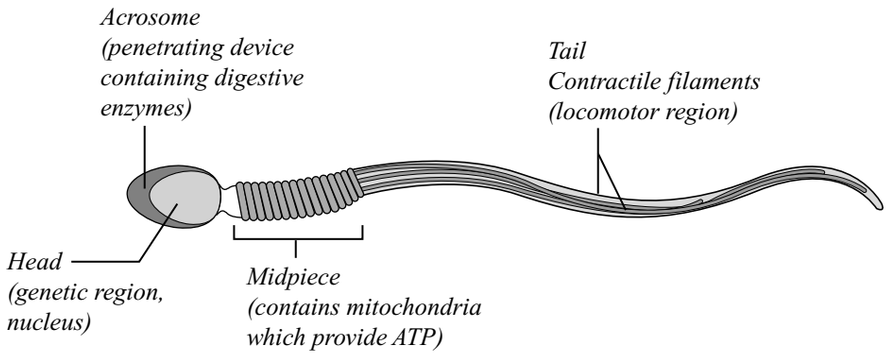
b 6. product of meiosis I

6. Why are spermatids not considered functional gametes? *Too much superfluous cytoplasm; nonmotile.*

7. Differentiate between *spermatogenesis* and *spermiogenesis*. *Formation of haploid gametes by the male.*

Sloughing off excessive spermatid cytoplasm to form a motile functional sperm.

8. Draw a sperm below and identify the *acrosome, head, midpiece,* and *tail*. Then beside each label, note the composition and function of each of these sperm structures.



9. The life span of a sperm is very short. What anatomical characteristics might lead you to suspect this even if you didn't know its life span? *No cytoplasm (to speak of) in which to store nutrients.*

Oogenesis, the Ovarian Cycle, and the Menstrual Cycle

10. The sequence of events leading to germ cell formation in the female begins during fetal development. By the time the child is born, all viable oogonia have been converted to *primary oocytes*.

In view of this fact, how does the total germ cell potential of the female compare to that of the male?

Much smaller, and the total number is predetermined.

11. The female gametes develop in structures called *follicles*. What is a follicle? *A structure consisting of a capsule of follicle (or granulosa) cells that encloses a developing gamete (oocyte).*

How are primary and vesicular follicles anatomically different? *The primary follicle has one or a small number of layers of follicle cells surrounding the oocyte; the vesicular follicle has a large antrum containing fluid produced by the granulosa cells, and the developing oocyte, surrounded by several layers of granulosa cells, is pushed to one side.*

What is a corpus luteum? *Glandular ovarian structure that produces progesterone. The ruptured vesicular follicle is converted to a corpus luteum.*

12. What is the major hormone produced by the vesicular follicle? *Estrogen*

By the corpus luteum? *Progesterone (and some estrogen)*

13. Use the key to identify the cell type you would expect to find in the following structures.

Key: a. oogonium b. primary oocyte c. secondary oocyte d. ovum

b 1. forming part of the primary follicle in the ovary

c 2. in the uterine tube before fertilization

c 3. in the mature vesicular follicle of the ovary

d 4. in the uterine tube shortly after sperm penetration

14. The cellular product of spermatogenesis is four *spermatids*; the final product of oogenesis is one *ovum* and three *polar bodies*. What is the function of this unequal cytoplasmic division seen during oogenesis in the female? *To provide the ovum or functional gamete with adequate nutritional reserves so that it can survive during its journey to the uterus.*

What is the fate of the three tiny cells produced during oogenesis? *They deteriorate.*

Why? *They lack sustaining cytoplasm with nutrient reserves.*

15. The following statements deal with anterior pituitary, ovarian hormones, and hormonal interrelationships. Name the hormone(s) described in each statement.

FSH (follicle-stimulating hormone) 1. produced by primary follicles in the ovary

LH (luteinizing hormone) 2. ovulation occurs after its burstlike release

estrogen and *progesterone* 3. exert negative feedback on the anterior pituitary relative to FSH secretion

estrogen 4. stimulates LH release by the anterior pituitary

LH 5. stimulates the corpus luteum to produce progesterone and estrogen

LH 6. maintains the hormonal production of the corpus luteum in a nonpregnant woman

16. Why does the corpus luteum deteriorate toward the end of the ovarian cycle? *Because blood levels of the anterior pituitary hormone LH are extremely low.*

17. For each statement below dealing with hormonal blood levels during the female ovarian and menstrual cycles, decide whether the condition in column A is usually (a) greater than, (b) less than, or (c) essentially equal to the condition in column B.

	Column A		Column B
b	1. amount of estrogen in the blood during menses	. . . . .	amount of estrogen in the blood at ovulation
b	2. amount of progesterone in the blood on day 14	. . . . .	amount of progesterone in the blood on day 23
b	3. amount of LH in the blood during menses	. . . . .	amount of LH in the blood at ovulation
a	4. amount of FSH in the blood on day 6 of the cycle	. . . . .	amount of FSH in the blood on day 20 of the cycle
a	5. amount of estrogen in the blood on day 10	. . . . .	amount of progesterone in the blood on day 10

18. Ovulation and menstruation usually cease by the age of *55–60*.

19. What uterine tissue undergoes dramatic changes during the menstrual cycle? *Endometrium*

20. When during the female menstrual cycle would fertilization be unlikely? Explain why. *Any time but the three-day interval (days 14–16) around ovulation. (Twenty-eight day cycle is assumed.)*

21. Assume that a woman could be an "on demand" ovulator like the rabbit, in which copulation stimulates the hypothalamic-anterior pituitary axis and causes LH release, and an oocyte was ovulated and fertilized on day 26 of her 28-day cycle. Why would a successful pregnancy be unlikely at this time? *The hormonal production of the ovary has ceased; the endometrium is beyond the receptive stage and is ready to slough off in menses.*

22. The menstrual cycle depends on events within the female ovary. The stages of the menstrual cycle are listed below. For each, note its approximate time span and the related events in the uterus; and then to the right, record the ovarian events occurring simultaneously. Pay particular attention to hormonal events.

Menstrual cycle stage	Uterine events	Ovarian events
Menstruation	*Days 1–5. Endometrium is sloughing off.*	*Primary follicle begins to grow.*
Proliferative	*Days 6–14. Endometrium repaired, glands and blood vessels proliferate. Endometrium thickens.*	*Follicular growth continues and vesicular follicle(s) produced. Estrogen secreted and peaks at day 14. Ovulation occurs on the 14th day.*
Secretory	*Days 15–28. Vascular supply increases and glands begin secretory activity.*	*Ruptured follicle is converted to a corpus luteum, which begins to produce progesterone (and some estrogen). Peaks at day 23 and then begins to decline.*