Section 10.7: The Reproductive Hormones

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A. Answers may vary. Sample answer: I do not think that BPA should be used in manufacturing plastics. Studies have demonstrated the negative side effects of chronic exposure to BPA, especially on fetuses and young children. Therefore, we need to limit our exposure to this chemical. However, because BPA has been incorporated into plastics for over 50 years, there is an abundance of BPA in our environment, which in itself poses a risk to humans due to chronic exposure. Therefore, it is important that we stop using BPA in our manufacturing of plastics to begin to reduce these levels in our environment and reduce the risk to humans in future generations.

B. BPA has been shown to behave in a manner similar to estrogen. Prenatal exposure has been linked to neurological deformities. BPA has been shown to bind to the thyroid hormone receptor and therefore has adverse effects on thyroid hormone action. BPA may increase cancer risk.

C. BPA has been linked to the falling sperm count in males over the past 50 years. Studies on male factory workers in China who directly work with BPA showed that these men had sperm counts four times lower than men who do not work with BPA. This study suggests that exposure to BPA could be one factor in the general decline in male sperm count of the past half century.

D. Answers may vary. Sample answer: To avoid any potential risks of BPA to my own health, in the future, I will not purchase any plastic product that contains BPA. I will dispose of older household products that have BPA and will ensure that food is not warmed up in plastic containers. While some studies do not show links between BPA use and health risks, this cannot be interpreted as showing there is no link. Because my personal health is concerned, I evaluate evidence carefully and I cannot reasonably conclude from these studies that BPA is not dangerous.

E. Reports may vary. Reports should include an explanation of how BPA manages to transfer from plastics into humans (e.g., warming food in plastic containers, entry into the ground water from disposal of plastics), the effects of BPA on human health (including the pre-natal effects) as well as a comparison of the risks of BPA exposure to other everyday risks (exposure to UV light, exposure to other toxic substances in our food and or environment, for example, acrylamide from frying potatoes).

F. Letters may vary. Letters should include a clear opinion about whether BPA should be identified as a toxic substance. Arguments should include strong supporting evidence, which may include a summary of the potential health risks, or of lack of evidence thereof.

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1. Estrogen and progesterone are the main female sex hormones. They control the development of female secondary sex characteristics and the menstrual cycle. Testosterone is the main male sex hormone. It controls and regulates the production of sperm as well as the development of secondary male sex characteristics.

2. The ovarian cycle regulates the production and release of eggs by the ovaries in preparation for fertilization. The menstrual cycle regulates the preparation of the uterus for the implantation of a fertilized egg. The two cycles are carefully coordinated in a monthly cycle that prepares the body for pregnancy.

3. Follicle stimulation (start of menstrual cycle) → ovulation on day 14 → corpus luteum stimulates growth of uterine lining (luteal period) → if no fertilization, uterine lining sheds (menstruation) → follicle stimulation
4. Answers may vary. Sample answer: Some of the benefits of hormone replacement therapy (HRT) are possible prevention of osteoporosis and heart disease; some of the risks of HRT are formation of blood clots and an increased risk of ovarian and breast cancer.

5. Release of GnRH by hypothalamus $\rightarrow$ GnRH stimulates pituitary gland to release FSH and LH into bloodstream $\rightarrow$ FSH stimulates oocytes to begin mitosis in ovaries $\rightarrow$ follicle forms around oocyte $\rightarrow$ FSH and LH interact to stimulate estrogen secretion by the follicular cells $\rightarrow$ estrogen (in low amounts) feeds back and inhibits FSH $\rightarrow$ estrogen levels increase and stimulate a burst of FSH and LH from the pituitary and increased secretion of GnRH from hypothalamus $\rightarrow$ ovulation occurs as LH stimulates release of digestive enzymes by the follicle cells causing release of the egg $\rightarrow$ LH stimulates formation of corpus luteum $\rightarrow$ corpus luteum secretes estrogen and progesterone to stimulate growth of the uterine lining and inhibit contractions $\rightarrow$ progesterone inhibits the secretion of GnRH and, in turn, the secretion of FSH and LH $\rightarrow$ diminished signal for follicular growth $\rightarrow$ egg is fertilized in the oviduct $\rightarrow$ the sperm and egg pronuclei fuse, forming the zygote $\rightarrow$ mitotic divisions of the zygote initiate the embryonic stage $\rightarrow$ about 7 days after ovulation, the embryo implants in the uterine lining

6. Answers may vary. Answers should include three of the following hormones that are common to both males and females and that regulate both the menstrual cycle and the male reproductive function: GnRH, FSH, LH, and inhibin.

7. The sexual cycle of human females differs from the sexual cycle of other vertebrates in that human females are fertile year-round whereas other vertebrates have limited periods of fertility.

8. If a fertilizing sperm cell did not release nitric oxide in the egg, it is expected that the egg might be penetrated by many sperm cells. Nitric oxide released by the fertilizing sperm cell stimulates release of calcium, which keeps additional sperm out of the egg.

9. The effects of testosterone in males is similar to the effects of estrogen on females in that they are both steroid hormones involved in the development of secondary sex characteristics. In addition, estrogen is needed for egg development while testosterone stimulates the production of sperm cells.

10. hCG is important because it keeps the corpus luteum actively secreting progesterone and estrogen until the placenta is able to take over this function in the third month of fetal development, therefore maintaining a rich blood supply for the developing embryo.

11. If a woman is not ovulating, a doctor might suspect that the HPG axis (hypothalamus-pituitary-gonadal axis) is not functioning properly. The hypothalamus produces gonadotropin-releasing hormone (GnRH). The anterior portion of the pituitary gland produces luteinizing hormone (LH) and follicle-stimulating hormone (FSH), and the gonads produce estrogen and testosterone, all of which are important for egg development and ovulation.

12. Answers may vary. Sample answer: When estrogen and progesterone are no longer produced during menopause, several body systems will be affected. These include the following: 1) the reproductive and urinary systems. A woman might notice vaginal dryness, itching or burning, which may lead to painful intercourse or, occasionally, urinary symptoms; 2) the skeletal system. A common result of menopause is that bone density begins to decline more rapidly and this puts many women at risk for osteoporosis and loss of bone density; 3) the cardiopulmonary system. After menopause, women have an increased risk of heart attacks and other heart-related problems; and 4) the nervous system. Changes in estrogen are strongly linked to hot flashes and night sweats. Estrogen fluctuations can also affect the emotional state, causing shifts between sadness, anger, confusion, and in some cases, anxiety or depression.