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MCB 135E Final
December 16, 1995
Version A

T and F (2 points each)

1. There is a mixing of fetal and maternal blood in the human placenta.

2. The ductus venosus shifts fetal blood from umbilical to pulmonary veins.

3. During exercise, the developing muscle undergoes a decrease in muscle cells.

4. Erythroblastosis fetalis is a condition which becomes manifest late in fetal life or soon after birth, with excessive destruction of red blood cells.

5. Erythroblastosis fetalis may occur as a result of transplacental passage of an anti-Rh antibody (agglutinin) produced in an Rh-negative mother who has been immunized by the Rh-positive red cells of the fetus.

6. Placenta offers at all fetal ages a complete protection from maternal and environmental hazards.

7. Natural killer cells are stimulated by interferon and destroy cancer cells.

8. All antibodies are immunoglobulins but not all immunoglobulins are antibodies.

9. Dehydrotestosterone is a potent androgen formed from testosterone in androgen target tissues by the enzyme 5-alpha-reductase.

10. Systolic blood pressure decreases throughout childhood and reaches a plateau level at menarche.

11. The infant's lower ability to concentrate urine than the adult is due to a shorter loop of Henle and less excretion of urea.

12. Muscle hypertrophy occurs when the cross sectional area (cell size) of the muscle increases.

13. Muscle hyperplasia occurs when there is an increase in the number of muscle cells.

14. Both muscle hypertrophy and hyperplasia reduce muscle strength and development.

15. The establishment of the cyclic hypothalamic control of gonadotropin release in the XX female is currently thought to be due to lack of testosterone exposure during fetal development.

16. The Xq28 "gay gene" is a cluster of at least 200 genes with unknown function which is found in the DNA of many but not all gay men who have been studied.

17. Neurons located in the cerebral cortex determine traits, referred to as parental behaviors that are probably sex biased due to prenatal exposure to sex hormones.

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Multiple choice. Only one response is correct. (3 points per question)

18. Excessive consumption of ethanol by the pregnant mother induces increased frequency of:
    A. Abortions.
    B. Fetal death.
    C. Retarded fetal growth.
    D. Congenital defects.
    E. All of the above.

19. The presence in males in the X chromosome of genetic material located at Xq28:
    A. Has been related to male homosexuality.
    B. Maybe responsible for the transmission of hemophilia.
    C. May be responsible for the transmission of sickle cell anemia.
    D. May be responsible for the transmission of Huntington's disease.
    E. None of the above.

20. The hypothalamus:
    A. Is located at the base of the brain.
    B. Contains 12 clusters of neurons (called nuclei).
    C. Each hypothalamic nucleus may have several functions.
    D. Some hypothalamic neurons have receptors for sex steroid hormones and therefore are responsive to sex steroid actions.
    E. All of the above.

21. Responses to stress are initiated by:
    A. Stimulation of hypothalamic CRH to release pituitary ACTH and of ACTH to release adrenal glucocorticoids.
    B. Stimulation of hypothalamic GnRH to release pituitary FSH and LH.
    C. Stimulation of hypothalamic TRH to release pituitary TSH and thyroid to release T3 and T4.
    D. Inhibition of somatostatin resulting in increased levels of prolactin.
    E. None of the above.

22. Myoplasticity of skeletal muscle most effective at young ages:
    A. Implies that muscle cells change in response to metabolic and training demands.
    B. Is influenced by the nutritional state of the individual.
    C. Depends on the ability of recruiting an increasing number of muscle fibers during exercise.
    D. Depends also on the load against which the fibers contract.
    E. All of the above.

23. In the first 2-3 days of the second half of the menstrual period, the endocrine profile is:
    A. High progesterone & estrogens, high (but declining) FSH & LH levels.
    B. Low progesterone & estrogens, high (but declining) FSH & LH levels.
    C. High progesterone & low estrogens, high (but declining) FSH & LH levels.
    D. None of the above.
    E. All of the above.

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24. During the menstrual cycle, the uterine mucosa (UM) undergoes characteristic changes under the influence of the hormonal environment:
    A. In the first half, UM proliferates under the influence of estrogens.
    B. In the second half, secretion of uterine glands is stimulated under the influence of progesterone.
    C. In the second half, UM vascularization is increased under the influence of progesterone.
    D. In case of fertilization, these UM changes are preparatory to facilitate egg implantation.
    E. All of the above.

25. Basal metabolic rate changes with age:
    A. It is highest in the fetus.
    B. It is highest in the newborn.
    C. It is highest at adolescence.
    D. It is highest during sleep.
    E. None of the above.

26. Implantation of the fertilized egg in the uterine mucosa occurs days after fertilization:
    A. Day 1
    B. 7 days
    C. 10 days
    D. 15 days
    E. 30 days

27. In the fetus, the liver has all of the following functions, except:
    A. Produces red blood cells.
    B. Produces bile.
    C. Metabolizes lipids.
    D. Metabolizes proteins and carbohydrates.
    E. Detoxifies several drugs.

28. Which of the following is the correct developmental sequence with regard to the maturation of neurons?
    A. Proliferation, growth and differentiation, synaptogenesis, myelination.
    B. Myelination, synaptogenesis, growth and differentiation, proliferation.
    C. Proliferation, myelination, synaptogenesis, growth and differentiation.
    D. None of the above.
    E. All of the above.

29. Thermoregulation depends on the balance between heat production and heat loss. Newborns and infants have greater difficulty than adults in maintaining this balance because of greater heat loss due to the larger body surface. However, their body temperature remains normal under good climatic conditions because:
    A. They spend less energy in activity.
    B. They have considerable depots of brown. adipose tissue.
    C. They have frequent intake of foods.
    D. They are generally kept in a moderate temperature environment or they are provided with appropriate clothing.
    E. All of the above.

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30. With respect to the development of the mammary gland, select the incorrect answer:
    A. Estrogen stimulates proliferation of milk ducts and lobules.
    B. Prolactin stimulates milk production.
    C. Oxytocin stimulates myoepithelial cell contraction and milk letdown.
    D. Insulin and cortisol are not necessary for the growth of the gland.
    E. Prolonged high levels of prolactin as in continued lactation may reduce the production of gonadotropins and thus may serve as a contraceptive measure.

31. The period of adolescence:
    A. Includes functional changes involving all systems leading to the establishment of adulthood.
    B. Is characterized by the closure of the epiphyseal plates and termination of increase in stature.
    C. Results in the establishment of reproductive function.
    D. Both B and C.
    E. All of the above.

32. (9 points) The second spurt of accelerated growth that occurs at adolescence is produced, in addition to the growth-promoting actions of GH (_____), IGF-1 (_____) and the thyroid hormones, T3 and T4 (_____ and _____) by that of other potent anabolic hormones.

Please fill in the blanks with the complete name of the hormone(s). Also complete the following statements relating to the other growth promoting hormones at adolescence:

_____ from the hypothalamus.

_____ and _____ from the Anterior Pituitary.

_____ from the testis.

_____ from the ovary.

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33. (20) Nutrition, important for good health throughout life, is particularly crucial during prenatal life, infancy, childhood and adolescence. Malnutrition, in terms of both deficient or excessive nutrition, is a frequent factor in preventing optimal growth. Five such conditions are listed here. For each indicate:
    A) The approximate time in the lifespan when they occur.
    B) Their causes, if known.
    C) Their major symptoms.
    D) Their long-term consequences.

Marasmus

Kwashiorkor

Anorexia

Bulimia

Small-for-date

34. (10 points) Eliminating exposure to risk factors in our environment will significantly reduce the incidence of birth defects. Name five (5) categories of risk factors.
    1.
    2.
    3.
    4.
    5.

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35. (10 points) In a recent report in a medical journal, the authors conclude that the (FDA-approved) drugs methotrexate and misoprostol when given in combination are effective in inducing early abortions. [Note: both drugs are used clinically: methotrexate to treat cancer patients and misoprostol to medicate ulcers]. Knowing that methotrexate is also a folic acid antagonist, discuss briefly the implications of using the drug combination in pregnant women.

36. (12 points) Define the following statements/terms and explain the mechanisms underlining the statements/terms:

Secular trend in stature.

Secular trend in the age at menarche.

Development proceeds according to a well predictable timetable.

In which ways, knowledge of this "programmed" timetable may help us to obtain optimal growth?

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The capacity to maintain homeostasis and adapt to stress at the end of adolescence may be viewed as the sum of attained physiologic competence.

Skeletal muscle injury will lead to muscle damage and regeneration.

Compensatory growth.

Catch up growth.

Allometric growth.

Glucostat

Gonadostat

37. (20) The concept of maternal-placental-fetal unit emphasizes the close functional relationships

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between these three structures. Please fill in the blanks from the graph below which was distributed in class. Fill in with the names of the appropriate hormones in the spaces with the dotted lines.