PBIO 376 **NAME_____KEY_____**
FINAL Exam

Thursday, March 16th, 2023

Following directions on the mark-sense form, write your **name, and student number** in the blanks and fill in the bubbles. In addition, write your **name** on this exam.

When finished with the test, turn in both the mark-sense form and the exam at the front of the room.

PLACE ALL ANSWERS ON THE MARK-SENSE FORM

KEY: answers are in red, bold-face
MULTIPLE CHOICE: Always choose the BEST, most complete answer. (2 points each)

1. Which of the following hormones secreted by the adrenal gland is NOT a steroid hormone?
   a) aldosterone
   b) epinephrine
   c) cortisol
   d) testosterone
   e) androstenedione (an androgen)

2. Which of the following hormones will NOT RAISE plasma glucose?
   a) glucagon
   b) insulin
   c) cortisol
   d) growth hormone (GH)
   e) epinephrine

3. Which of the following can lead to Cushing's syndrome? (Choose best.)
   a) high dosage of oral cortisol-like drug
   b) a pituitary tumor causing high adrenocorticotropin hormone (ACTH) secretion
   c) an adrenal gland tumor that secretes high cortisol
   d) A, B, and C above can all lead to Cushing's syndrome
   e) an autoimmune attack on the adrenal gland

4. Which of the following represents a negative feedback loop that occurs in normal physiology?
   a) high cortisol suppressing the secretion of corticotropin releasing hormone (CRH)
   b) high aldosterone suppressing the secretion of CRH
   c) high ACTH suppressing the secretion of adrenal androgens
   d) high testosterone suppressing the secretion of estrogen
   e) high CRH suppressing the secretion of epinephrine

5. Methimazole is an inhibitor of the enzyme thyroid peroxidase, and thus, interferes with the production of thyroid hormones (T3 and T4). What would you expect to experience if you took too much methimazole?
   a) You would become overheated.
   b) You would develop a goiter.
   c) You would feel tired and have low energy.
   d) You would have a pounding, high heart rate.
   e) You would lose weight.

NOTE: The answer we were looking for related to the function of thyroid hormone and the expected symptoms of hypothyroidism, i.e. c) You would feel tired and have low energy. However, it is true that hypothyroidism could cause elevated TSH secretion and development of a goiter and so we also accepted answer b.

6. Which of the following is NOT a feature associated with individuals who have congenital iodine deficiency syndrome (previously known as endemic cretinism)?
   a) high or rapid metabolism
   b) short stature
   c) goiter
   d) profound cognitive (intellectual) disability
   e) delays in motor development

7. Which of the following best describes thyroglobulin?
   a) a protein that iodinates thyroid hormones
   b) a protein that cleaves thyroid hormones
   c) an antibody that attacks the thyroid gland
   d) a protein that serves as the backbone for the synthesis of thyroid hormones
   e) a protein that binds to thyroid hormones for transport through the blood stream

8. What is TRUE about the treatment for primary congenital hypOthyroidism, where a defective thyroid gland is discovered at birth?
   a) No treatment is required.
   b) It can be treated with thyroid hormone supplementation any time before puberty.
   c) It is treated with surgery.
   d) It is treated with iodine supplementation.
   e) It must be treated with thyroid hormone supplementation within two weeks of birth.

9. Which of the following does NOT regulate the secretion of growth hormone (GH)?
   a) growth hormone releasing hormone (GHRH)
   b) somatostatin
   c) GH
   d) gastrin
   e) insulin-like growth factor-1 (IGF-1)

10. Which of the following conditions occurs as the result of abnormally high GH secretion BEFORE puberty?
    a) gigantism
    b) Laron dwarfism
    c) hypoglycemia
    d) acromegaly
    e) decreased IGF-1 levels

11. Which of the following constitutes a DIRECT effect of GH?
    a) hypoglycemia
    b) increased insulin sensitivity
    c) hyperglycemia
    d) lipogenesis
    e) suppression of IGF-1 secretion

12. What is the hormone secreted from the liver that mediates the anabolic actions of GH?
    a) glucagon
    b) insulin
    c) cortisol
    d) ghrelin
    e) IGF-1

13. Which hormone promotes epiphyseal closure in both males and females?
    a) testosterone
    b) estrogen
    c) GH
    d) somatostatin
    e) aldosterone

14. Parathyroid hormone (PTH) has it secretion suppressed/inhibited by which of the following signals?
    a) too little sunshine
    b) a rise in plasma Ca^{++} levels
    c) a rise in blood glucose
    d) a drop in plasma Ca^{++} levels
    e) a decrease in bone density

15. Which of the following is TRUE regarding the active form of vitamin D_3?
    a) It promotes the absorption of Ca^{++} from the diet.
    b) It promotes Ca^{++} excretion by the kidneys.
    c) Too much active vitamin D_3 causes rickets.
    d) It increases passive filtration of Ca^{++} into the kidneys.
    e) It is synthesized in the anterior pituitary gland.

16. Which of the following cells will secrete hydrochloric acid (HCl) to dissolve bone matrix?
    a) hematopoietic stem cells
    b) osteoblasts
    c) osteocytes
    d) chondrocytes
    e) osteoclasts

17. The cells of a 48, XXXY individual will possess how many Barr bodies?
    a) none
    b) one
    c) two
    d) three
    e) four

18. When does meiosis first commence in FEMALES?
    a) during embryogenesis
    b) during childhood
    c) at the beginning of puberty
    d) after the end of puberty
    e) at menopause

19. How many mature sperm will arise from one spermatogonium?
    a) one
    b) two
    c) three
    d) four
    e) eight

20. A genotype of 45, XO would be most likely to be associated with which of the following?
    a) a phenotypic male individual
    b) a phenotypic female individual
    c) an individual with ambiguous genitalia
    d) an individual with female genitalia that masculinizes at puberty
    e) an individual with male external genitalia but also possessing ovaries

21. Which hormone causes the degeneration of the female ductal system in males?
    a) estrogen
    b) testosterone
    c) anti-Müllerian hormone (AMH)
    d) dihydrotestosterone (DHT)
    e) gonadotropin releasing hormone (GnRH)

22. Which of the following is NOT found in females with Complete Androgen Insensitivity Syndrome (CAIS)?
    a) ovaries
    b) testes
    c) defective testosterone receptors in target tissue
    d) lack of male ductal system (vas deferens, etc.)
    e) lack of menstruation

23. Sperm maturation is the acquisition of the biochemical ability to fertilize an egg. Where does this occur?
    a) seminiferous tubule
    b) epididymis
    c) vas deferens
    d) prostate gland
    e) female reproductive tract

24. In the MALE, luteinizing hormone (LH) exerts its primary effect on which cells?
    a. thecal cells
    b. granulosa cells
    c. Sertoli cells
    d. Leydig cells (interstitial cells)
    e. spermatogonia

25. Which one of these will exert a positive feedback effect on hormone secretion by the anterior pituitary?
    a) low estrogen levels
    b) rising levels of growth hormone
    c) rising levels of cortisol
    d) sustained high estrogen levels
    e) sustained high androgen levels

26. Which of the following starts at the onset of puberty in children?
    a) sustained secretion of luteinizing hormone during the daytime
    b) pulsatile secretion of GnRH from the hypothalamus
    c) proliferation of primordial germ cells in the gonads
    d) sustained high estrogen secretion
    e) a desire for a cell phone

27. Which hormone is highest during the follicular phase of the female menstrual cycle?
    a) testosterone
    b) dihydrotestosterone (DHT)
    c) estrogen
    d) progesterone
    e) human chorionic gonadotropin (HCG)

28. How do female birth control pills prevent pregnancy?
    a) High estrogen forces early ovulation before the uterine lining is ready.
    b) They raise the level of androgens to prevent ovulation.
    c) They contain human chorionic gonadotropin (HCG) that mimics pregnancy to suppress ovulation.
    d) They supply high progesterone which exerts negative feedback to suppress follicle stimulating hormone (FSH) and luteinizing hormone (LH) secretion.
    e) They raise the level of FSH and confuse the ovary.

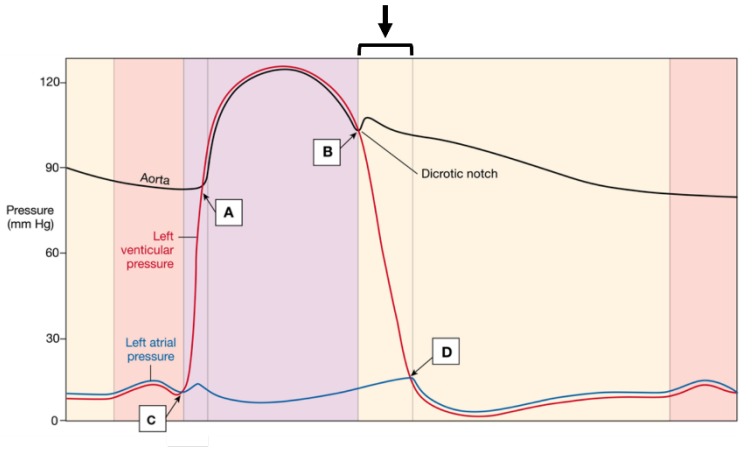
29. During which phase of life does the number of eggs in a human female decrease by atresia (a type of programmed cell death)?
    a) before birth
    b) during the first few months after birth
    c) during childhood
    d) after puberty
    e) at all stages of life prior to menopause

30. Which hormone is measured to determine if a woman is pregnant?
    a) thyroid stimulating hormone (TSH)
    b) luteinizing hormone (LH)
    c) follicle stimulating hormone (FSH)
    d) human chorionic gonadotropin (HCG)
    e) inhibin

31. Which of the following is responsible for <u>closing</u> the left AV valve (mitral valve)?
    a) pressure in the aorta is greater than pressure in the left ventricle
    b) increase in central venous pressure
    c) contraction of the papillary muscles
    d) pressure in the left ventricle is greater than pressure in the left atrium
    e) pressure in the left atrium is greater than pressure in the left ventricle

32. Which of the following is NOT TRUE about cells in the SA node?
    a) electrical activity requires activation by sympathetic neurons
    b) cells do not have a resting membrane potential
    c) cells fire action potentials
    d) hyperpolarization-activated channels initiate a pacemaker potential
    e) cells are electrically coupled

33. Refer to the figure at right. What is true about the phase of the cardiac cycle that is indicated by the bracket?
    a) the ventricles are contracting
    b) the atria are contracting
    c) the pressure in the ventricles is not changing
    d) the volume in the ventricles is not changing
    e) all the valves are open



34. Which of the following is an effect of norepinephrine on the heart? (Choose best.)
    a) increases the slope of the pacemaker potential
    b) increases release of Ca^{++} from the sarcoplasmic reticulum in cardiac muscle cells
    c) increases cardiac contractility
    d) increases heart rate
    e) ALL of the above are effects of norepinephrine on the heart.

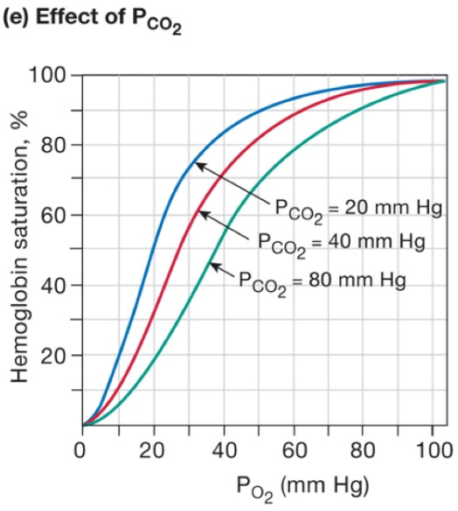
35. Heart failure always involves a <u>decrease</u> in
    a) ECF volume.
    b) cardiac output.
    c) angiotensin II.
    d) edema.
    e) respiratory rate.

36. All of the following are characteristic of cystic fibrosis EXCEPT
    a) increased bacterial infections in lungs
    b) thick mucus in lungs
    c) decreased mucus clearance from airways
    d) increased fluid secretion by airway epithelium
    e) defective activity of apical Cl^- channel

37. Fill in the blanks. Surfactant _____ lung compliance by _____ surface tension.
    a) increases; decreasing
    b) decreases; decreasing
    c) increases; increasing
    d) decreases; increasing

38. For which of the following disorders does alveolar ventilation decrease due to lung compliance being too low?
    a) emphysema
    b) asthma
    c) pulmonary fibrosis (restrictive lung disease)
    d) cystic fibrosis
    e) opioid overdose

39. Refer to the graph at right. At a high partial pressure of CO_2 (80mm Hg), the hemoglobin saturation curve shifts to the right. This means that in metabolically active tissues
    a) O_2 dissociates more readily from hemoglobin.
    b) O_2 binds more tightly to hemoglobin.



40. Hyperventilation that occurs during strenuous exercise is a response to
    a) metabolic acidosis.
    b) a drop in arterial PO_2.
    c) a drop in $[H^+]$.
    d) increased PCO_2.
    e) increased heart rate.

41. Where would you find microvilli?
    a) in the lamina propria of the esophagus
    b) in the antrum of the stomach
    c) on the basolateral surface of parietal cells
    d) between the circular and longitudinal muscle of the muscularis externa
    e) on the apical membrane of enterocytes

42. ALL of the following promote acid secretion EXCEPT
    a) food in the stomach
    b) gastrin
    c) increased H^+ in the duodenum
    d) histamine
    e) acetylcholine

43. Which of the following triggers bile release?
    a) bicarbonate secreted by the pancreatic duct cells
    b) cholecystokinin (CCK)
    c) high pH in the duodenum
    d) contraction of the sphincter of Oddi
    e) vitamin B_{12}

44. Fat digestion is enabled by emulsification, where large fat droplets are broken into small droplets that are coated with
    a) triacylglycerol.
    b) enzymes.
    c) amphipathic molecules.
    d) H^+ ions.
    e) glucose.

45. Which of the following is the enzyme that releases absorbed fats from chylomicrons?
    a) chymotrypsin
    b) lipoprotein lipase
    c) enteropeptidase
    d) HMG-CoA reductase
    e) H^+/K^+-ATPase

46. Which of the following hormones dominates the FASTED state metabolism?
    a) GLP-1
    b) insulin
    c) insulin-like growth factor-1 (IGF-1)
    d) leptin
    e) glucagon

47. Which of the following is measured when using indirect calorimetry to determine how much energy the body is using?
    a) calories in food ingested
    b) CO_2 exhaled
    c) heat given off
    d) weight of feces
    e) volume of urine

48. Which of the following conditions puts an individual at the greatest risk of developing life-threatening ketoacidosis?
    a) type 1 diabetes mellitus
    b) type 2 diabetes mellitus
    c) following the keto diet
    d) following the grapefruit diet
    e) diabetes insipidus

49. Which of the following hormones has the longest half-life in the body?
    a) glucagon
    b) luteinizing hormone (LH)
    c) thyroid hormone (T4)
    d) epinephrine
    e) insulin

50. The hypothalamic releasing hormones (-RH) exert their effect on cells located where?
    a) liver
    b) testes and ovaries
    c) pancreas
    d) anterior pituitary
    e) posterior pituitary

END OF TEST

Please turn in your mark-sense form and your question sheets at the front of the room.