PBIO 376 **NAME_____KEY_____**
FINAL exam

Thursday, March 14th, 2024

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.

Answers are in red bold-face.

PLACE ALL ANSWERS ON THE MARK-SENSE FORM

MULTIPLE CHOICE: Always choose the BEST, most complete answer. (2 points each)

1. Which of the following glands does not secrete steroid hormones?
   a. adrenal cortex
   b. adrenal medulla
   c. testis
   d. ovary
   e. zona reticularis of the adrenal cortex

2. Which of these conditions causes Addison's disease (low cortisol production)?
   a. a cortisol-secreting tumor in the adrenal gland
   b. autoimmune attack on the thyroid gland
   c. a pituitary tumor that secretes high levels of ACTH (adrenocorticotropic hormone)
   d. autoimmune attack on the adrenal gland
   e. excessive tanning

3. Which of the following hormones will promote Na^+ reabsorption in the kidney in response to a drop in blood pressure?
   a. GnRH (gonadotropin releasing hormone)
   b. ACTH
   c. aldosterone
   d. cortisol
   e. oxytocin

4. If you are out on an urban walk, and a car jumps the sidewalk heading right for you, which hormone is likely to be most helpful for you to flee the car and survive this stressful situation?
    a. T3 (thyroid hormone)
    b. cortisol
    c. epinephrine
    d. PTH (parathyroid hormone)
    e. estrogen

5. Which of these conditions can cause a goiter (enlarged thyroid gland)?
    a. thyroid tumor
    b. low dietary iodine causing iodine deficiency
    c. Hashimoto's thyroiditis
    d. Graves' disease
    e. ALL the above can cause a goiter.

6. Which of the following disorders causes much lower than normal secretion of TSH (thyroid stimulating hormone)?
    a. Graves' disease
    b. Hashimoto's thyroiditis
    c. endemic low iodine
    d. hyperparathyroidism
    e. elevated blood pressure

7. Which of the following drugs would most likely be prescribed to treat HyPERthyroidism?
    a. synthetic T4
    b. synthetic T3
    c. synthetic T3/T4 combination
    d. methimazole (inhibits thyroid peroxidase)
    e. iodine supplementation

8. What does thyroid hormone (T3/T4) do?
    a. contributes to nervous system development in children
    b. increases basal metabolic rate in adults
    c. BOTH A and B
    d. decreases basal metabolic rate in adults
    e. BOTH A and D

9. GH (growth hormone) has many target tissues. Which of the following is the principal target tissue that mediates the indirect, growth-promoting effects of GH by secreting the IGFs (insulin-like growth factors)?
    a. pancreas
    b. kidney
    c. brain
    d. liver
    e. lungs

10. Which of the following is a direct metabolic effect of GH?
    a. promotes protein breakdown
    b. raises plasma glucose
    c. inhibits bone growth
    d. increases insulin sensitivity
    e. lowers plasma glucose

11. When is the best time to provide GH supplementation to a patient in order to increase height?
    a. at night
    b. first thing in the morning
    c. in response to a high protein meal
    d. after puberty
    e. before puberty

12. Individuals with Laron Syndrome (dwarfism caused by complete loss of functional GH receptors) would exhibit which plasma levels for GH and IGF-1 (insulin-like growth factor-1)?
    a. high GH, high IGF-1
    b. high GH, low IGF-1
    c. low GH, high IGF-1
    d. low GH, low IGF-1
    e. normal GH, high IGF-1

13. Which type of cell is primarily responsible for the synthesis and deposition of bone matrix (hydroxyapatite)?
    a. chondrocyte
    b. fibroblast
    c. osteoclast
    d. osteoblast
    e. thecal cell

14. Which of the following is associated with hyperparathyroidism?
    a. accidental damage to the parathyroid gland from neck surgery
    b. osteoporosis (fragile bones due to loss of bone mineral density)
    c. DiGeorge Syndrome (born without parathyroid glands)
    d. autoimmune damage to parathyroid glands
    e. low serum calcium

15. Which of the following is secreted in response to a RISE in plasma calcium?
    a. PTH
    b. calcitonin
    c. calcitriol ($1,25(OH)_2D_3$ or active vitamin D)
    d. cortisol
    e. anti-Müllerian hormone (AMH)

16. Which of the following organs or tissues are important in maintaining plasma calcium at the appropriate level?
    a. intestine
    b. kidney
    c. bone
    d. parathyroid gland
    e. ALL of the above tissues are important in maintaining plasma calcium levels.

17. When does sexual differentiation begin in humans?
    a. week 7 of embryonic development
    b. birth
    c. childhood
    d. puberty
    e. menopause

18. What is the sexual phenotype of a 47, XXX individual? How many Barr bodies would be found in this Individual's somatic cell nuclei?
    a. phenotypic male; 1 Barr body
    b. phenotypic male; 2 Barr bodies
    c. phenotypic female; 1 Barr body
    d. phenotypic female; 2 Barr bodies
    e. intersex phenotype; 1 Barr body

19. Which of the following hormones is directly responsible for promoting the development of the male ductal system (seminal vesicle, vas deferens, epididymis) in a paracrine fashion?
    a. anti-Müllerian hormone (AMH)
    b. estrogen
    c. testosterone
    d. GnRH (gonadotropin-releasing hormone)
    e. somatostatin

20. The rare condition called Swyer Syndrome results in the development of someone with an XY genotype into a female-appearing individual with a uterus, fallopian tubes, and vagina, but no ovaries or testes. What gene product is non-functional or missing in most of these individuals?
    a. estrogen receptor
    b. androgen receptor
    c. GH receptor
    d. GH
    e. sex-determining region of the Y chromosome (SRY)

21. When does meiosis first begin during the process of gamete development in human females?
    a. prior to birth
    b. during childhood
    c. during the follicular phase of the cycle after puberty
    d. during the luteal phase of the cycle after puberty
    e. at menopause

22. Complete development of male external genitalia is dependent on which enzyme and hormone?
    a. aromatase, estrogen
    b. 5-alpha reductase, DHT (dihydrotestosterone)
    c. 21-hydroxylase, aldosterone
    d. 5-alpha reductase, estrogen
    e. aromatase, testosterone

23. What forms the structural basis for the blood-testis barrier?
    a. Leydig (interstitial) cells within the interstitial testis
    b. special fluids within the epididymis
    c. tight junctions between adjacent Sertoli cells
    d. regression of the Müllerian ducts
    e. flagella within the seminiferous tubules

24. Which of the following hormones exhibits negative feedback on the secretion of both LH (luteinizing hormone) and FSH (follicle-stimulating hormone)?
    a. aldosterone
    b. renin
    c. insulin
    d. testosterone
    e. TRH (thyrotropin-releasing hormone)

25. Why don't 45, XO females develop ovaries?
    a. They lack the SRY gene.
    b. Two X chromosomes are required at certain times during development to make ovaries.
    c. GnRH secreting cells fail to migrate to the hypothalamus during development.
    d. They have a mutation in the androgen receptor.
    e. They have high levels of testosterone that prevent ovarian development.

26. What is the ultimate fate for the majority of eggs produced by human females?
    a. ovulation
    b. fertilization
    c. used to produce new bone marrow
    d. maintained throughout life to secrete estrogen
    e. programmed cell death (atresia)

27. Which of the following will elicit a positive feedback effect on the secretion of both LH and FSH?
    a. **sustained high estrogen secretion midway through the follicular phase of the female cycle**
    b. X chromosome inactivation in somatic cells
    c. high progesterone secretion during the luteal phase of the female cycle
    d. high basal body temperature after ovulation
    e. tonic (steady and continuous) administration of GnRH

28. Secretion of the hormone oxytocin stimulates smooth muscle contractions in the uterus. Which of the following is another effect of oxytocin?
    a. beard growth
    b. promotes regression of the Müllerian ducts
    c. promotes binding of the sperm head to the outer layer of the egg
    d. **stimulates smooth muscle contraction in the breast to eject milk**
    e. promotes sperm maturation

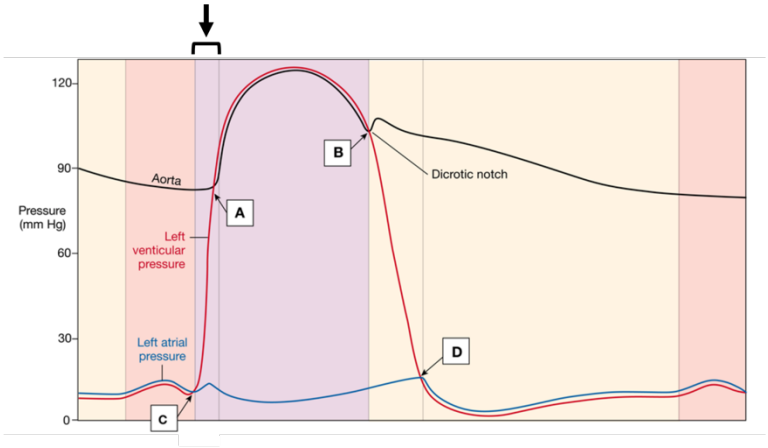
29. Where in the female reproductive tract is fertilization most likely to occur?
    a. **fallopian tube**
    b. fluid outside ovary
    c. uterus
    d. cervix
    e. vagina

30. Which of these events occurs in the epididymis?
    a. spermatocytes complete meiosis
    b. **sperm acquire progressive forward motility**
    c. sperm develop tails
    d. spermatogonia divide by mitosis
    e. acrosomal membrane fuses with the outer layer of the egg

31. Which of the following is TRUE about the right ventricle?
    a. pumps blood at a lower pressure than the left ventricle
    b. pumps blood to the coronary arteries
    c. normally pumps blood to the right atrium
    d. contraction in the right ventricle creates the second heart sound
    e. pumps blood to the systemic circulation

32. Which of the following prevents the transfer of electrical excitation between the atria and ventricles, so that the atria contract before the ventricles?
    a. intercalated disks
    b. AV node
    c. bundle of His
    d. fibrous connective tissue skeleton associated with the valves
    e. papillary muscles

33. Refer to the figure at right. What is occurring in the heart at the time indicated by the bracket?
    a. the ventricles are relaxing
    b. the atria are contracting
    c. all the valves are open
    d. the pressure in the ventricles is not changing
    e. the volume in the ventricles is not changing



34. Which of the following is increased by parasympathetic input to the heart?
    a. time between action potentials in the SA node
    b. contraction strength
    c. opening of I_f ("funny ") channels
    d. Ca^{++} permeability in contractile cells
    e. Ca^{++} permeability in SA node cells

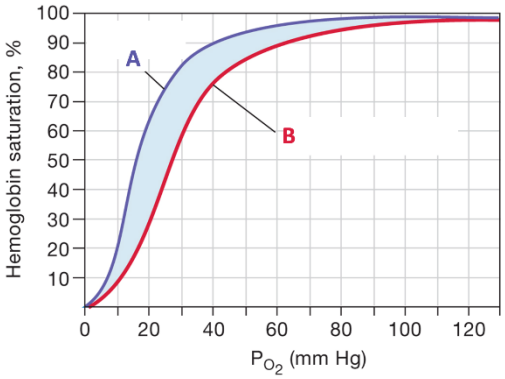
35. Muscle pumping involves contraction of skeletal muscles that compresses veins and increases venous return. What is the effect of increasing venous return?
    a. decreases central venous pressure
    b. increases preload (the filling of the heart)
    c. increases heart rate
    d. increases total peripheral resistance
    e. decreases end-diastolic volume

36. In heart failure, cardiac output decreases, lowering blood flow to certain tissues. What occurs because of low blood flow to the kidney?
    a. decreased production of angiotensin II
    b. decreased secretion of aldosterone
    c. decreased ECF volume
    d. increased secretion of renin
    e. increased glucose reabsorption

37. Which of the following occurs in the genetic disorder cystic fibrosis?
    a. increased sympathetic activity stimulating airway smooth muscle contraction
    b. lack of surfactant secretion by type II alveolar cells
    c. lack of fluid secretion by airway epithelial cells
    d. increased mucus secretion by goblet cells
    e. thickened connective tissue in alveoli

38. Which of the following is TRUE about surfactant?
    a. Surfactant increases the surface tension of the fluid lining the alveoli.
    b. Surfactant decreases the compliance of the lungs.
    c. Surfactant contains amphipathic molecules that collect at the air-water interface.
    d. Surfactant is secreted by type I alveolar cells.
    e. Surfactant sticks the pleural membranes together, which decreases the work of breathing.

39. Which line represents the hemoglobin saturation curve for fetal hemoglobin?
    a. A
    b. B



40. Fill in the blank. During strenuous exercise, _____ stimulates the peripheral chemoreceptor to cause hyperventilation.
    a. decreased PO_2
    b. increased PCO_2
    c. increased pH
    d. decreased PCO_2
    e. increased $[H^+]$

41. The folds of the apical cell membrane of an enterocyte are called
    a. microvilli
    b. plicae circulares
    c. villi
    d. lacteals
    e. crypts

42. ALL the following stimulate acid secretion EXCEPT
    a. gastrin
    b. acetylcholine released from enteric neurons that innervate parietal cells
    c. histamine
    d. food in the stomach
    e. prostaglandins

43. Duodenal ulcers occur when H pylori infection causes antral gastritis, endocrine dysfunction, and acid hypersecretion. Which of the following hormones shows increased secretion that stimulates parietal cell proliferation and acid hypersecretion?
    a. secretin
    b. somatostatin
    c. insulin
    d. gastrin
    e. CCK (cholecystokinin)

44. Which of the following proteins plays a key role in fluid and bicarbonate secretion by duct cells in the pancreas?
    a. H^+/K^+-ATPase
    b. SGLT2
    c. CFTR
    d. nicotinic acetylcholine receptor
    e. enteropeptidase

45. Which of the following is an effect of the hormone CCK (cholecystokinin)?
    a. stimulates smooth muscle contraction in the Sphincter of Oddi
    b. inhibits smooth muscle contraction in the gallbladder
    c. promotes release of bile into the duodenum
    d. stimulates acid secretion in the stomach
    e. ALL of the above are effects of CCK

46. What are micelles?
    a. triacylglycerol-rich lipoproteins synthesized by enterocytes
    b. cholesterol-rich lipoproteins synthesized by hepatocytes
    c. lipoproteins that deliver cholesterol to cells
    d. tiny particles that deliver fat digestion products to the apical membrane of enterocytes
    e. large droplets of triacylglycerol where fat digestion occurs

47. Which of the following is a leptin-deficient state that can be effectively treated with leptin injections?
    a. type 1 diabetes mellitus
    b. degeneration of adipose tissue (lipodystrophy)
    c. adrenal insufficiency (hypocortisolism)
    d. common obesity
    e. Cushing's syndrome (hypercortisolism)

48. Which of the following is not characteristic of the fasted state?
    a. hepatic glucose production
    b. increased glucose uptake by adipocytes
    c. gluconeogenesis
    d. ketogenesis
    e. lipolysis

49. Which of the following hormones has its secretion triggered by increased plasma glucose?
    a. GH (growth hormone)
    b. insulin
    c. glucagon
    d. cortisol
    e. epinephrine

50. Insulin resistance is the key characteristic in
    a. the fed state.
    b. adrenal insufficiency.
    c. growth hormone resistance.
    d. the metabolic response to the ketogenic diet.
    e. type 2 diabetes mellitus.

END OF TEST

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

Have a great break from classes.
Best wishes for the future!