

YR 1 PHYSIOLOGY UNIT EXAMINATION 3 -- April 14, 1997.

CHOOSE THE SINGLE BEST ANSWER FOR QUESTIONS 1 - 60.

1. Which is a cholesterol-derived hormone secreted by the adrenal gland?
 - A. aldosterone
 - B. vitamin D
 - C. calcitonin
 - D. adrenocorticotrophic hormone (ACTH)
 - E. epinephrine

2. Luteinizing hormone (LH) regulation of progesterone secretion from the ovarian luteal cells is classified as a(n) _____ mechanism.
 - A. intracrine
 - B. autocrine
 - C. paracrine
 - D. neurocrine
 - E. endocrine

3. Which hormone has receptors embedded in the plasma membranes of its target cells?
 - A. epinephrine
 - B. vitamin D
 - C. cortisol
 - D. aldosterone
 - E. dihydrotestosterone

4. Which does NOT increase plasma prolactin level?
- A. stress
 - B. suckling
 - C. copulation in female rats
 - D. slow wave sleep
 - E. elevated plasma estradiol
5. Which is true concerning inorganic iodide metabolism in the thyroid gland?
- A. Iodide (I) is transported by an active transport mechanism into the parafollicular cells.
 - B. In the thyroid follicular colloid, most iodine atoms are contained in thyroxine.
 - C. Thyroxine binding globulin is the primary carrier of inorganic iodide in the plasma.
 - D. Thyrotropin or thyroid stimulating hormone (TSH) has no effect on iodide uptake into thyroid follicular cells.
 - E. Iodide is converted to iodine before incorporation into tyrosyl residues of thyroglobulin.
6. An injection of _____ increases the metabolic rate (O_2 consumption) in humans.
- A. reverse triiodothyronine
 - B. tyrosine
 - C. monoiodothyronine
 - D. diiodotyrosine
 - E. None of the above

7. Which does NOT characterize hypothyroidism?
- A. reduced basal metabolic rate
 - B. reduced rate of lipogenesis
 - C. reduced plasma level of cholesterol
 - D. impaired growth rate in children
 - E. reduced rate of glycogenolysis
8. Which enzyme is critical for gluconeogenesis?
- A. phosphofructokinase
 - B. citrate lyase
 - C. pyruvate dehydrogenase
 - D. pyruvate kinase
 - E. glucose-6-phosphate phosphatase
9. Free fatty acids derived from fat cells are transported in the blood primarily as:
- A. free fatty acids bound to albumin.
 - B. very low density lipoproteins.
 - C. high density lipoproteins.
 - D. integral components of chylomicrons.
 - E. soluble components in serum.

10. An aqueous extract of the hypothalamus will stimulate a cultured pituitary gland to secrete:
- A. dopamine.
 - B. adrenocorticotrophic hormone (ACTH).
 - C. triiodothyronine.
 - D. oxytocin.
 - E. prolactin.
11. The pituitary gland contains neural components and epithelial components. Which is of epithelial origin?
- A. pars tuberalis
 - B. median eminence
 - C. infundibular stem
 - D. tuber cinereum
 - E. infundibular process
12. The blood supply to the anterior pituitary is unique in that:
- A. it receives both arterial and venous blood.
 - B. it receives arterial blood from two sources, the inferior hypophyseal and trabecular arteries.
 - C. it receives only venous blood from capillaries in the median eminence and posterior pituitary.
 - D. it receives arterial blood from the trabecular artery and venous blood from the pars nervosa.
 - E. it receives blood exclusively from the long portal blood vessels.

13. Which characteristics do the circumventricular organs have in common?
- A. ependymal cells with cilia
 - B. a blood-brain barrier
 - C. fenestrated endothelium
 - D. a low level of vascularization
 - E. All the above
14. The secretion of _____ by the anterior pituitary is regulated by a positive feedback system.
- A. adrenocorticotrophic hormone (ACTH)
 - B. thyroid stimulating hormone (TSH)
 - C. follicle stimulating hormone (FSH) in the male
 - D. luteinizing hormone (LH)
 - E. growth hormone (GH) in the female
15. The increased elimination of CO_2 from the body after epinephrine release is due to:
- A. the increase in lactic acid production, which results in increased CO_2 in expired air.
 - B. the decrease in respiration.
 - C. the retention of bicarbonate ions by the kidney, which results in alkalosis.
 - D. the increase in blood pressure, which changes the PCO_2 in alveolar air.
 - E. the decrease in peripheral resistance.

16. The secretions of the adrenal medulla contract some smooth muscles but relax others. Which is true?
- A. The smooth muscle of the splenic capsule relaxes.
 - B. The dilator pupillae of the iris relaxes.
 - C. Sphinctors of the gastro-intestinal tract relax.
 - D. The non-sphinctoric muscles of the bladder relax.
 - E. The smooth muscles of the bronchioles contract.
17. The administration of androgens increase muscle mass by increasing:
- A. the number of muscle fibers.
 - B. the size of individual muscle fibers.
 - C. neural activity at the neuromuscular junction.
 - D. the synthesis and storage of fructose.
 - E. the blood flow, and thus the nutrient delivery, to the muscle.
18. Which does NOT express 5 alpha reductase?
- A. prostate
 - B. facial hair follicles
 - C. kidney
 - D. seminal vesicles
 - E. sebaceous glands of the skin

19. The increase in estradiol during the follicular phase of the menstrual cycle:
- A. induces endometrial proliferation of the uterus.
 - B. stimulates a mid cycle surge of follicle stimulating hormone (FSH) and luteinizing hormone (LH).
 - C. stimulates proliferation of the granulosa cells of the ovary.
 - D. All the above
 - E. A and B above
20. In response to progesterone, the human kidney transiently:
- A. decreases glucose reabsorption, and excretion increases.
 - B. increases calcium secretion.
 - C. decreases calcium excretion.
 - D. increases H⁺ ion secretion.
 - E. increases sodium excretion, and total body sodium is decreased.
21. The secretions of the cervix are more acidic and thicker under the stimulation of:
- A. estrogen.
 - B. prolactin.
 - C. relaxin.
 - D. progesterone.
 - E. inhibin.

22. Which is true concerning estrogen synthesis by the ovary?
- A. Testosterone is produced by the granulosa cells and is transported to the theca cells for estrogen production.
 - B. The theca cells have follicle stimulating hormone (FSH) receptors and produce estrogens by utilizing androgens from the circulation.
 - C. The granulosa cells have luteinizing hormone (LH) receptors which stimulate the production of both testosterone and the aromatase enzyme.
 - D. The granulosa cells have FSH receptors which stimulate the production of androgens, and the theca cells have LH receptors which stimulate aromatase enzymes and estrogens.
 - E. The theca cells have LH receptors which produce androgens, and the androgens go to the granulosa cells where, under stimulation by FSH, the aromatase enzyme is produced and estrogens are made.
23. An adult male patient presents with soft pale skin, disproportionate length of long bones, poor muscular development, and poor body hair development. Which would improve all of the symptoms?
- A. testosterone
 - B. dihydrotestosterone
 - C. growth hormone (GH)
 - D. All the above are required to improve all of the symptoms
 - E. None of the above, because some of the symptoms are not reversible with hormone therapy

24. A tall 19 year old female, who is the long distance running champion for the State of Michigan, sees a physician because she exhibits little evidence of puberty (no breast development and no menstruation) and is about 20% below her ideal weight. She has no other obvious abnormality. Which is a reasonable explanation?
- A. Low percentage of body fat probably delayed puberty.
 - B. She has an adrenal tumor that is producing large amounts of androgens which are suppressing follicle stimulating hormone (FSH) and luteinizing hormone (LH) secretion.
 - C. She has an ovarian tumor which is secreting large amounts of estrogen which has decreased her food intake.
 - D. She is hypothyroid caused by Hashimoto s disease.
 - E. There is nothing wrong with her. She is just a "late bloomer."
25. A bolus injection of _____ would be most effective in enhancing insulin secretion by the beta cells.
- A. norepinephrine
 - B. insulin
 - C. somatostatin
 - D. growth hormone releasing factor (GHRH)
 - E. the gastrointestinal hormone, gastric inhibitory peptide (GIP)
26. High plasma concentrations of insulin:
- A. increase Glut-1 and Glut-2 mediated glucose transport in adipose tissue.
 - B. decrease intracellular metabolism of glucose.
 - C. decrease triglyceride synthesis in adipose tissue.
 - D. stimulate lipoprotein lipase activity in adipose tissue.
 - E. increase ketone production and utilization.

27. High plasma concentrations of glucagon:
- A. increase glycogenolysis and increase glucose production by the liver.
 - B. increase gluconeogenesis and increase amino acid concentrations in the plasma.
 - C. decrease ketogenesis and decrease the rate of ketone excretion.
 - D. increase plasma glucose but decrease plasma free fatty acids.
 - E. increase production of triglycerides in adipose tissue.
28. Cortisol increases plasma glucose by increasing:
- A. protein synthesis and thereby sparing glucose utilization.
 - B. cholesterol metabolism thereby blocking glucose utilization.
 - C. gluconeogenesis.
 - D. carbohydrate absorption in the gastrointestinal tract.
 - E. fatty acid utilization and thereby increasing glucagon breakdown.
29. Which can be attributed to an action of adrenocorticotrophic hormone (ACTH)?
- A. increased adenylate cyclase mediated desmolase activity in adrenal cortex
 - B. conversion of cholesterol to cholesterol esters for lipid storage
 - C. increased low density lipoprotein (LDL) receptor synthesis in adipose tissue
 - D. decreased mitosis, but hypertrophy of adrenal cortical cells
 - E. All the above.

30. Aldosterone:
- A. decreases sodium reabsorption by the renal proximal tubules.
 - B. increases potassium secretion by the distal tubules and collecting ducts.
 - C. increases blood angiotensin II and causes prolonged hypertension.
 - D. increases plasma potassium by blocking insulin mediated potassium uptake.
 - E. stimulates adrenocorticotrophic hormone (ACTH) secretion, thereby increasing cortisol secretion.
31. Which is most effective in stimulating osteocytes and osteoblasts to release calcium?
- A. parathyroid hormone (PTH)
 - B. calcitonin related peptide
 - C. insulin-like growth factor 1 (IGF-1)
 - D. 24,25-dihydroxycholecalciferol
 - E. gastrin related peptides
32. Which is true concerning the regulation of calcium metabolism?
- A. 1 α -hydroxylase in the kidney is inhibited by parathyroid hormone (PTH).
 - B. 1 α -hydroxylase in the kidney is stimulated by high phosphate.
 - C. The parathyroid gland is stimulated by high phosphate and low calcium concentrations in the plasma.
 - D. Low plasma calcium stimulates parafollicular cells to increase calcitonin secretion.
 - E. 1,25 dihydroxy vitamin D₃ has a positive feedback effect to stimulate 1 α -hydroxylase in the kidney.

33. Which is characteristic of a lack of glucocorticoid production (Addison's disease)?
- A. persistent low plasma glucose.
 - B. persistent high blood pressure.
 - C. decreased skin pigmentation.
 - D. increased potassium excretion.
 - E. increased fat deposition.
34. Which is true concerning growth hormone (GH)?
- A. GH secretion is stimulated by low plasma concentrations of glucose and fatty acids.
 - B. GH directly stimulates fat synthesis and thereby increases adipose tissue mass.
 - C. Destruction of the GH secreting cells of the pituitary has a diabetogenic effect.
 - D. A high protein diet suppresses GH production.
 - E. The combination of high estrogens and thyroxin is associated with decreased GH secretion.
35. Which is an indirect effect of growth hormone (GH), actually mediated by insulin-like growth factor 1 (IGF-1)?
- A. stimulation of sulfate incorporation into cartilage
 - B. stimulation of lipolysis in adipose tissue
 - C. inhibition of glucose uptake and utilization in skeletal muscle
 - D. blockade of insulin receptors in skeletal muscle
 - E. stimulation of hepatic glucose production

Choose the best answer for the next six questions from the list. An answer may be used once, more than once, or not at all.

- A. growth hormone (GH)
- B. luteinizing hormone (LH)
- C. estradiol
- D. insulin
- E. human chorionic gonadotropin (hCG)
- F. oxytocin
- G. dehydroepiandrosterone (DHEA)
- H. follicle stimulating hormone (FSH)
- I. thyroid hormone
- J. cortisol
- K. melatonin
- L. gonadotropin releasing hormone (GnRH)
- M. testosterone
- N. progesterone
- O. melanocyte stimulating hormone (MSH)

- 36. In females, the growth spurt and closure of the epiphyses during puberty is likely to be due to this hormone.
- 37. This hormone increases the number of gap junctions in the uterus during pregnancy.
- 38. This hormone is responsible for milk ejection as well as for signaling parturition.
- 39. The most common cause of cardiovascular disease and osteoporosis in post-menopausal women is due to a reduction in the level of this hormone.
- 40. Changes in the secretion of this hormone, secreted by the pineal gland, may be related to the changes in sleep patterns in aging.
- 41. In males, development of the secondary sexual characteristics during puberty is primarily due to this hormone.

42. A woman treated with large doses of glucocorticoids for rheumatoid arthritis is likely to exhibit:
- A. low levels of pituitary hormones derived from the pro-opiomelanocortin (POMC) gene.
 - B. hypertension.
 - C. hypopigmentation.
 - D. osteoporosis.
 - E. All the above
43. An anterior pituitary tumor which secretes adrenocorticotrophic hormone (ACTH) may:
- A. inhibit the secretion of hypothalamic somatotropin releasing hormone.
 - B. inhibit the secretion of somatomedins (IGF-1).
 - C. cause hypoglycemia due to the peripheral action of adrenocorticotrophic hormone (ACTH).
 - D. increase the probability of pathologic bone fractures due to increased bone catabolism.
 - E. increase the formation of protein in bone.
44. The clinical chart of a 40 year old woman lists the following findings. Which finding is NOT consistent with the others?
- A. osteoporosis
 - B. high plasma concentration of cortisol
 - C. high plasma concentration of adrenocorticotrophic hormone (ACTH)
 - D. fasting plasma glucose = 150 mg per dl
 - E. diurnal variations in plasma cortisol concentration

45. Which is true?
- A. Insulin insufficiency increases gastrointestinal (GI) tract motility.
 - B. Increased plasma glucose in diabetes decreases GI tract secretion.
 - C. Platelet aggregation is decreased in diabetes.
 - D. Diabetes causes an increase in nerve conduction velocity and baroreflex sensitivity.
 - E. Cholesterol synthesis is decreased in diabetes.
46. Repeating episodes of hyperinsulinism in a patient receiving intensive insulin therapy may:
- A. increase plasma Na and K concentrations.
 - B. increase vascular contractility by increasing calcium ion concentration in smooth muscle cells.
 - C. cause vasodilatation by inhibiting the production of nitric oxide (NO).
 - D. increase sympathetic nerve activity and blood pressure.
 - E. alter nerve conduction velocity by stimulating the polyol pathway.
47. Diabetes-induced vascular disease may include:
- A. changes in structure and permeability of the capillary basement membrane.
 - B. proliferation of retinal capillaries due to hypoxia-induced secretion of angiogenin.
 - C. occlusion due to smooth muscle hypertrophy and lipid plaque formation.
 - D. prostaglandin-induced increases in platelet aggregation.
 - E. All the above

48. Polyuria (increased urine flow) in a poorly controlled diabetic patient is due to:
- A. increased permeability of the glomerular capillaries.
 - B. decreased water reabsorption due to renal tubular disease.
 - C. glucose-induced osmotic diuresis.
 - D. loss of autonomic nervous system control of the urinary bladder.
 - E. excessive drinking of fluids with low sodium content.
49. Which stimulate(s) renin secretion in untreated type I diabetes mellitus?
- A. decreased blood pressure detected by the juxtaglomerular cells
 - B. increased activity of the renal sympathetic nerves
 - C. decreased Na load in the macula densa segment of the nephron
 - D. All the above
 - E. A and B above
50. Which increase(s) secretion of K ions in untreated type I diabetes mellitus?
- A. increased Na load in the distal tubule and collecting duct
 - B. the presence of unreabsorbable anions in tubular fluid in the distal tubule and collecting duct
 - C. increased aldosterone secretion due to increased concentration of angiotensin II in plasma
 - D. All the above
 - E. A and C above

51. A normal overnight fast may:
- A. decrease the secretion of insulin, thereby decreasing the amount of nutrients used by the liver and adipose tissue.
 - B. increase the secretion of glucagon, thereby promoting the mobilization of nutrients stored in the liver and adipose tissue.
 - C. decrease the secretion of glucagon, thereby sparing glucose by decreasing the breakdown of liver glycogen.
 - D. A and B above
 - E. A and C above
52. The increase in body weight due to the consumption of a constant amount of food in excess of metabolic requirements does not continue indefinitely because the extra calories:
- A. stimulate heat production by the white adipose tissue.
 - B. stimulate the futile cycles that result in increased glucose utilization.
 - C. are needed to carry the extra body weight.
 - D. the basal metabolic rate increases in proportion to the increased body surface area.
 - E. None of the above
53. Which is true concerning brown adipose tissue?
- A. It is capable of oxidative phosphorylation and cannot produce ATP.
 - B. It contains a proton transfer protein that is not found in other tissues.
 - C. Its function is stimulated by catecholamines.
 - D. Its hypertrophy is a major cause of weight loss in hyperthyroidism and anorexia.
 - E. Its mass is increased following adaptation to a hot environment.

54. Which is NOT increased by extended (weeks) physical training?
- A. coronary vascularization
 - B. electron transport efficiency
 - C. tolerance to stress
 - D. blood cholesterol and triglycerides
 - E. glucose intolerance
55. Which stimulates glycogenolysis in skeletal muscle cells?
- A. vitamin D
 - B. glucagon
 - C. growth hormone (GH)
 - D. insulin
 - E. None of the above
56. Which is the major source of total body ATP generation when the percent of VO_2 max exceeds 85?
- A. glycogen
 - B. muscle triglycerides
 - C. plasma free fatty acids
 - D. plasma neutral amino acids
 - E. plasma glucose

57. Which would you expect in a patient with heart failure?
- A. increased heart rate at rest
 - B. high plasma levels of norepinephrine
 - C. distended jugular veins
 - D. low stroke volume
 - E. All the above
58. Which would you expect in a patient with heart failure? (LVEDP = left ventricular end diastolic pressure)
- A. normal LVEDP, low stroke volume
 - B. high LVEDP, normal stroke volume
 - C. low LVEDP, low cardiac output
 - D. high LVEDP, low stroke volume
 - E. None of the above
59. Which is FALSE?
- A. Positive and negative Na balances always induce changes in arterial plasma Na concentration (A_{Na}).
 - B. A negative Na balance results when $U_{Na} \cdot V$ exceeds dietary Na.
 - C. In Na balance, dietary Na is approximately equal to urinary Na excretion.
 - D. ECV is regulated by regulating the total amount of Na in the body.
 - E. Positive and negative Na balances induce changes in extracellular fluid volume (ECV).

60. Which does NOT occur in congestive heart failure?
- A. increased activity of the sympathetic nervous system due to decreased pressure in the aortic arch and carotid sinuses
 - B. decreased secretion of atrial natriuretic hormone (or factor or peptide) due to decreased atrial pressure and/or stretch
 - C. increased secretion of renin due to decreased pressure detected by juxtaglomerular cells
 - D. decreased activity of the parasympathetic nervous system due to decreased pressure in the aortic arch and carotid sinuses
 - E. increased reabsorption of Na ions in the distal tubule and collecting duct due to increased plasma aldosterone concentration