

1. All of the following are true of skeletal muscle contraction EXCEPT
  - A. ATP binds to myosin and causes myosin to detach from actin
  - B. Myosin catalyzes the reversible hydrolysis of ATP at the catalytic site but the products remain tightly bound to the enzyme until actin binds and displaces phosphate
  - C. The myosin-ADP-actin complex undergoes a conformation change with release of ADP
  - D. The power stroke in muscle contraction occurs when the myosin headpiece re-attaches to actin
  - E.  $\text{Ca}^{++}$  regulates the contraction process by allowing the myosin-ADP-Pi complex to interact with actin filaments
  
2. Malignant hyperthermia occurs in 1:20,000 surgical procedures where muscle relaxants and general inhalation anesthetics are used. Malignant hyperthermia is caused by:
  - A. an uncoupling of oxidative phosphorylation in muscle mitochondria by the anesthetics
  - B. stimulation of  $\text{Na}^+\text{-K}^+$  ATPase activity
  - C. the formation of stable myosin-actin crossbridges that cannot be broken by ATP
  - D. an elevated level of intracellular  $\text{Ca}^{++}$  that promotes continuous muscle contraction with associated increased ATP hydrolysis and oxidative phosphorylation
  - E. the depolymerization of F-actin to produce G-actin

3. Microtubules are involved in
- A. cell division
  - B. ciliar and flagellar movement
  - C. movement of secretory vesicles along axons
  - D. movement of organelles within cells
  - E. all of the above
4. Muscle proteolysis is accompanied by the release of ala and gln from muscle. What is the carbon source of these amino acids?
- A. muscle protein, because it has a high content of ala and gln
  - B. glucose
  - C. creatinine
  - D. glycerol
  - E. acetoacetate
5. A female patient with Cushings disease is distinguishable by
- A. low plasma ACTH, urinary  $17\alpha$ -hydroxycorticosteroids > 100 mg/day and urinary 17-ketosteroids < 12 mg/day
  - B. high plasma ACTH, urinary  $17\alpha$ -hydroxycorticosteroids > 100 mg/day and urinary 17-ketosteroids > 12 mg/day
  - C. high plasma angiotensin II, low urinary  $\text{Na}^+$  and low urinary tetrahydroaldosterone
  - D. high plasma ACTH, urinary 17-ketosteroids > 17 mg/day and urinary estrogen > 60 mg/day
  - E. muscle waste, hypertension and a beard

6. A patient with secondary aldosteronism will display
- A. high serum Na<sup>+</sup>, high serum aldosterone and no serum renin
  - B. high serum Na<sup>+</sup>, high serum renin, low serum aldosterone
  - C. hypertension and elevated serum renin
  - D. no serum ACTH, no serum aldosterone and high serum Na<sup>+</sup>
  - E. masculinization and hypertension
7. A patient with Familial Hypercholesterolemia has a defect in the clustering of LDL receptors in coated pits. Incubation of this patient's fibroblasts with <sup>125</sup>I-LDL for 1 hour will result in
- A. most of the <sup>125</sup>I-LDL being internalized in the cells
  - B. most of the <sup>125</sup>I-LDL being degraded
  - C. most of the <sup>125</sup>I-LDL being bound to the surface of the cells
  - D. most of the <sup>125</sup>I-LDL being converted to <sup>125</sup>I-VLDL
  - E. most of the <sup>125</sup>I-LDL undergoing lysosomal digestion
8. In relation to hepatic cells from a normal person on a low animal fat diet, hepatic cells from a normal person on a prolonged high animal fat diet will
- A. contain higher amounts of cholesterol
  - B. contain a lower number of LDL receptors
  - C. contain a less active HMG-reductase
  - D. contain fewer mRNAs for the LDL receptor
  - E. all of the above are correct

Choose the single best answer for the following questions.

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9. A person with type IIA hyperlipoproteinemia (Familial Hypercholesterolemia) had a blood cholesterol level of 360 mg/dl (recommended level below 200 mg/dl) and a blood triglyceride (triacylglycerol) level of 140 mg/dl (recommended level below 160 mg/dl). This person most likely has

- A. a decreased ability for receptor-mediated endocytosis of LDL
- B. a decreased ability to degrade the triacylglycerols of chylomicrons
- C. an increased ability to produce VLDL
- D. an elevation of HDL in the blood
- E. a decreased ability to convert VLDL to IDL

10. A person with an LDL-receptor deficiency was treated with lovastatin. As a consequence of the action of this drug, the person should have

- A. fewer LDL receptors in cell membranes
- B. increased de novo cholesterol synthesis
- C. increased LCAT activity
- D. lower blood cholesterol levels
- E. higher blood triacylglycerol levels

11. A patient with hyperlipoproteinemia would be most likely to benefit from a low-carbohydrate diet if the lipoproteins that are elevated in the blood are

- A. chylomicrons
- B. VLDL
- C. LDL
- D. HDL<sub>2</sub>
- E. HDL<sub>3</sub>

12. The liver does not accumulate excessive amounts of cholic and chenodeoxycholic acids because

- A. these bile acids are totally excreted from the intestine
- B. high levels of cholic acid will block directly HMG-reductase
- C. high levels of these bile acids will block  $7\alpha$ -hydroxylase
- D. these bile acids will be incorporated into VLDL and passed into the plasma
- E. excess levels of the precursors of cholesterol will be converted instead into steroid hormones

13. A young female patient suffering from an adrenogenital syndrome characterized by an inactive  $11\beta$ -hydroxylase will display

- A. the effects of excess glucocorticoids and hypertension as well as high levels of tetrahydrocortisol in the urine
- B. the effects of excess androgens and hypertension as well as high levels of pregnanediol and pregnanetriol in the urine
- C. the effects of excess androgens and hypertension as well as high levels of tetrahydroaldosterone in the urine
- D. the effects of excess androgens and high levels of salt in the urine
- E. the effects of excess DHEA and hypertension as well as high salt in the urine

14. In a fasting person, glucagon will affect the de novo synthesis of cholesterol in liver

- A. by bringing about the phosphorylation of HMG-reductase which deactivates this enzyme
- B. by bringing about the phosphorylation of HMG-reductase which activates this enzyme
- C. by increasing the level of acetyl CoA
- D. by increasing gluconeogenesis
- E. by bringing about the dephosphorylation of HMG-reductase which deactivates this enzyme

15. A new drug "zaragozic acid" is now available which blocks the squalene synthetase system and therefore dramatically lowers the plasma cholesterol levels in hypercholesterolemia patients. Lovastatin, which completely blocks HMG-reductase, lowered cholesterol plasma levels in these patients to a similar degree. Would you prefer to prescribe

- A. lovastatin because it will cause an increase in HMG-CoA which can be metabolized to ketone bodies
- B. lovastatin because it will permit the synthesis of isoprene units
- C. lovastatin because it will increase the synthesis of squalene
- D. zaragozic acid because it will not block the synthesis of isoprene units and farnesyl pyrophosphate
- E. zaragozic acid because it will not prevent the synthesis of 7-dehydrocholesterol, a vitamin D<sub>3</sub> precursor

Choose the single best answer for the following questions.

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16. Lymphocytic leukemia can become resistant to treatment by glucocorticoids or glucocorticoid drugs because

- A. these cells can metabolize certain glucocorticoids to inactive metabolites
- B. these cells can lose the expression of the glucocorticoid receptor
- C. the glucocorticoid receptor may become mutated so that the receptor complex no longer interacts properly with its responsive element
- D. these cells may more actively convert cortisol to cortisone
- E. all of the above are correct

17. In a normal person, hypertension is prevented because the kidney tubule cell contains

- A. only an aldosterone specific receptor
- B. an inactive 21-hydroxylase
- C. a high affinity  $11\beta$ -hydroxysteroid dehydrogenase
- D.  $17\beta$ -hydroxysteroid dehydrogenase
- E. peripheral aromatase

The following two questions are related

18. A postmenopausal patient presents with a breast tumor. Proteins in the cytosol from a homogenate of a biopsy of this tumor display high affinity, specific binding of tritiated estradiol and tritiated progesterone. Treatment of this patient with an antihormone such as tamoxifen is warranted because

- A. the tumor is hormone dependent (responsive)
  - B. the tumor contains active estrogen receptor
  - C. an estrogen regulated gene is turned on
  - D. the patient is postmenopausal
  - E. all of the above are correct
19. It is also reasonable to treat this patient with
- A. diethylstilbesterol (DES)
  - B. CGP-47,645
  - C. spironolactone
  - D. finasteride
  - E. MER-25

The following two questions are related

20. A patient with prostate cancer responded best when he was treated with a combination of flutamide and finasteride. An analysis of this tumor before treatment would be expected to show the presence of

- A. aromatase and lutenizing hormone (LH) receptor
- B. desmolase and 17,20-lyase
- C. androgen receptor and 5 $\alpha$ -reductase
- D. only the androgen testosterone
- E. both the androgen and glucocorticoid receptors

21. The nuclear DNA from this prostate tumor would be expected to contain

- A. mutated Zn-fingers
- B. NF- $\kappa$ B
- C. Ras-GTP
- D. the appropriate hormone response element (HRE) upstream of responsive genes
- E. all of the above are correct

22. Ovarian follicular growth in a patient is best measured by

- A. the level of plasma ACTH
- B. the level of plasma LH
- C. the urinary level of 17-ketosteroids
- D. the urinary level of progesterone (pregnanediol)
- E. the urinary level of estriol

23. A patient is having difficulty conceiving. An analysis of her plasma shows that the level of FSH is low and the level of estrogen is constantly high. Her pituitary function is normal and, other than hypersecretion of androstenes, her ovary is normal. Ovulation can be induced in this patient by administering for a short period (5 days)

- A. lutenizing hormone
- B. an antiestrogen
- C. progesterone
- D. RU-486
- E. prolactin

24. Important to the control of steroid hormone synthesis by ACTH, LH or FSH is the fact that

- A. high levels of cholesterol will downregulate the LDL receptor
- B. phospholipase A<sub>2</sub> hydrolyzes arachidonate from membrane phospholipids
- C. desmolase resides in the mitochondria
- D. all three of these polypeptides are bound by the same membrane receptor
- E. the steroid hormone secreted by the endocrine tissue cannot down regulate the secretion of ACTH, LH or FSH

25. Hyperglycemia in patients with diabetes mellitus results from which of the following?

- A. increased lipolysis in adipose tissue and skeletal muscle
- B. increased hepatic gluconeogenesis and decreased glycolysis in adipose tissue and skeletal muscle
- C. decreased proteolysis and increased lipolysis in adipose tissue
- D. increased glycogen synthesis and decreased glycogenolysis in adipose tissue and skeletal muscle
- E. increased lipogenesis and increased glycogen synthesis in adipose tissue and skeletal muscle

Choose the single best answer for the following questions.

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26. The acidosis of diabetic ketoacidosis results from which of the following?

A. increased lipolysis in adipose tissue resulting from increased lipoprotein lipase activity

B. increased lipolysis in adipose tissue resulting from increased hormone sensitive triglyceride lipase activity

C. increased lipolysis in adipose tissue resulting from increased monoglyceride lipase activity in hepatocytes

D. increased glycolysis due to increased glycogen phosphorylase a activity in adipose tissue and skeletal muscle

E. increased glycolysis resulting from increased phosphofructokinase activity in liver and skeletal muscle

In each group, for each numbered question select the best lettered answer. Each lettered answer may be selected once, more than once, or not at all.

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27. Elevated levels in blood following severe crushing injury can lead to renal damage

28. Urinary levels are used as a marker for muscle proteolysis

A. succinyl CoA

B. succinyl choline

C. creatinine

D. 3-methyl histidine

E. dystrophin

F. myoglobin

In each group, for each numbered question select the best lettered answer. Each lettered answer may be selected once, more than once, or not at all.

29. Low serum  $\text{Ca}^{++}$  ( $< 10 \text{ mg } \%$ ) and normal serum phosphate will normally be accompanied by

30. Low serum phosphate and normal serum  $\text{Ca}^{++}$  will be normally accompanied by

31. Analysis of serum from a patient with x-linked hypophosphatemia will display

A. elevated serum levels of PTH, elevated serum levels of  $1\alpha,25(\text{OH})_2 \text{ Vit D}_3$

B. elevated serum levels of PTH, low serum levels of  $1\alpha,25(\text{OH})_2 \text{ Vit D}_3$

C. low serum levels of PTH, high serum levels of  $1\alpha,25(\text{OH})_2 \text{ Vit D}_3$

D. low serum levels of PTH, low serum levels of  $1\alpha,25(\text{OH})_2 \text{ Vit D}_3$

E. none of the above

In each group, for each numbered question select the best lettered answer. Each lettered answer may be selected once, more than once, or not at all.

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32. An agonist binding to its membrane receptor brings about

$\text{GDP}\cdot\text{G}\alpha,\beta\gamma + \text{GTP} \rightarrow \text{G}\beta,\gamma + \text{GDP} + \text{GTP}\cdot\text{G}\alpha$  which initiates

33. An agonist binding to its membrane receptor brings about the activation of phospholipase A<sub>2</sub> which initiates

34. An agonist binding to its membrane receptor brings about the activation of tyrosine kinase which initiates

A. the metabolic formation of diacylglycerol which activates protein kinase A

B. the activation of Ras and the hydrolysis of arachidonate from position 2 of a phospholipid

C. the activation of Ras which ultimately brings about the phosphorylation of nuclear regulatory proteins

D. the binding of  $\text{Ca}^{++}$  to calmodulin which activates cyclooxygenase

E. the metabolic formation of cAMP which activates protein kinase C

F. the formation of and binding of cAMP to an enzyme protein

G. the hydrolytic production of a substrate for cyclooxygenase