

The examples of the questions for SMC № 5

1. Which one of the following statements is FALSE?

- a. Myoglobin and hemoglobin are alike in that both contain heme with iron bound as Fe^{2+} .
- b. 2, 3-bisphosphoglycerate binds with equal affinity to fetal hemoglobin and to adult hemoglobin.
- c. The positive cooperativity for the binding of O_2 to hemoglobin facilitates the delivery of O_2 to metabolically active tissues.
- d. The binding of O_2 to hemoglobin is increased by an increase in pH.
- e. Hemoglobin A contains a glutamate residue at the 6th position in the β -chain while hemoglobin S contains a valine residue at the 6th position in the β -chain.

2. The binding of O_2 to hemoglobin is _____ by an increase in the concentration of CO_2 and is _____ by a decrease in the concentration of 2, 3-bisphosphoglycerate.

- a. increased, increased
- b. increased, decreased
- c. decreased, decreased
- d. decreased, increased
- e. decreased, unchanged

3. What is the difference between collagen Type I and collagen Type II?

- a. Type II is a proteolytically processed form of Type I.
- b. Type II is a dimer of Type I.
- c. They are encoded by a different set of genes.
- d. Type I is intracellular and Type II is extracellular.
- e. There is no real difference; this is an obsolete terminology.

4. Which one of the following statements is FALSE with respect to collagen biosynthesis?

- a. Procollagen polypeptides are hydroxylated on proline and lysine residues in the endoplasmic reticulum.
- b. Glycosylation occurs in the endoplasmic reticulum and/or the Golgi apparatus.
- c. After secretion, propeptides are removed to form tropocollagen.
- d. Assembly of collagen fibers in the matrix begins with association of polypeptides to form a triple helix.
- e. Crosslinking reinforces the final fibrous assembly in the matrix.

5. Which one of the following statements about an antibody class switch from IgM to IgG is FALSE?

- a. A DNA rearrangement occurs causing the constant region of the heavy chain to be replaced.
- b. The event is coordinated with somatic hypermutation and additional clonal selection such that IgG has higher affinity for the antigen.
- c. Memory cells originating from this event will retain surface bound IgG as their antigen receptor.
- d. Antibodies produced in a subsequent secondary response will be of class IgG.

- e. Interaction with complement characteristic of IgM will be lost while excellent agglutination capabilities characteristic of IgG will be gained.

6. Antibody/antigen interactions _____.

- a. are mainly based on hydrogen bonds, hydrophobic interactions, and charge-charge interactions
- b. are based on the same kinds of chemical interactions used by enzymes to bind their substrates
- c. tend to be stereospecific
- d. feature high affinity binding
- e. All of the above.

7. In the primary response, only B lymphocyte clones capable of making antibody specific to antigens present are observed to expand and produce plasma cells. How is this achieved?

- a. Naive B lymphocytes are each committed to make antibodies with a particular antigen binding site, and use their antibody in the form of surface bound IgM to detect presence of the antigen and trigger activation.
- b. B lymphocytes also express T cell receptor.
- c. B lymphocytes ingest antigen and repeatedly rearrange their immunoglobulin gene segments until a gene is assembled making an antibody that binds the antigen. This triggers activation.
- d. B lymphocytes are first triggered to replicate by the presence a signal from T cells. They rearrange their Ig gene segments later to match an antigen.
- e. From birth, the genome only contains Ig genes capable of making antibody against serious pathogens.

8. Which one of the following classes of molecules will bind foreign antigen but WITHOUT extensive specificity?

- a. IgM
- b. IgG
- c. IgE
- d. T cell receptor
- e. Class I or II Major Histocompatibility molecules (also known as MHC or HLA).

9. Which one of the following is NOT characteristic of the immediate (within a few minutes) response to a severe tissue injury?

- a. activation of kininogen to kinin
- b. activation of the coagulation cascade
- c. platelet activation
- d. display of markers in capillaries recognized by neutrophils
- e. fibrinolysis

10. Some degree of chronic inflammation is found in most adult patients in the form of _____.

- a. von Willebrand's disease
- b. periodontitis
- c. scurvy
- d. a collagen type I defect
- e. aspirin overdose

11. The aspirin effect on hemostasis is more profound than other Non Steroidal AntiInflammatory Drugs (NSAIDs) because _____.

- a. aspirin is more soluble in the blood
- b. aspirin is an irreversible inhibitor
- c. aspirin inhibits a different enzyme than any other NSAID
- d. platelets are more permeable to aspirin
- e. aspirin inactivates four coagulation factors: II, VII, XI, and X

12. The last step in the coagulation cascade is _____.

- a. cleavage of fibrinogen by thrombin to make fibrin.
- b. cleavage of plasminogen by thrombin to make plasmin
- c. cleavage of fibrin by thrombin
- d. cleavage of thrombin
- e. cleavage of gamma carboxyglutamate to make glutamate

13. O₂ bound to hemoglobin does not have its O-O bond perpendicular to the plane of the heme. This effect is caused by the distal histidine and is known to explain which one of the following:

- a. cooperativity of O₂ binding
- b. the Bohr effect
- c. solubility of hemoglobin
- d. ratio of CO/O₂ binding over 100x lower than it would otherwise be
- e. the binding of BPG

14. Binding of which one of the following (a) occurs at only one place in a hemoglobin tetramer and (b) causes the affinity of hemoglobin for O₂ to decrease?

- a. BPG
- b. CO₂
- c. H⁺
- d. O₂
- e. heme

15. Which one of the following summarizes the Bohr effect?
- O₂ binding causes conformational change that explains co-operativity.
 - Histidine moves O₂ out of the heme plane when it binds in a fifth coordination site.
 - Binding of BPG to hemoglobin lowers the affinity of O₂.
 - Hemoglobin folds with hydrophobic amino acids internal.
 - CO₂ and H⁺ cause hemoglobin's binding of O₂ to decrease.
16. In which one of the following properties is collagen like alpha keratin?
- Both perform their functions in the extracellular matrix.
 - Both are extensively cross-linked, although by different mechanisms.
 - In both, hydrogen bonds connect three polypeptide chains into a triple helix.
 - Both contain a lot of glycine, and are critically vulnerable to mutations at glycine residues.
 - Both are the targets of adhesion proteins.
17. Which one of the following statements about the biosynthesis of collagen is FALSE?
- Procollagen contains propeptides required for proper triple helix formation.
 - A defect in collagen hydroxylation would result in reduced collagen secretion.
 - The aldol crosslinks in collagen are formed from post translationally hydroxylated lysine residues.
 - A typical collection of polypeptide chains in a tropocollagen molecule would be $\alpha_1(I)$, $\alpha_1(II)$, and $\alpha_1(III)$.
 - Genetic defects in type I collagen may lead to a condition called dentinogenesis imperfecta.
18. Which one of the following statements about proteoglycan aggregate is FALSE?
- It is the major component of ground substance.
 - It is modified by glycosaminoglycan on the N and C termini, and then crosslinked by disulfide bonds.
 - It is secreted as proteoglycan monomer, and then assembles further onto a strand of hyaluronic acid with the aid of a link glycoprotein.
 - Its major function is to bind up water and take up space.
 - It is highly negatively charged.
19. Which one of the following does NOT bind the F_C region of any antibodies of any class?
- foreign antigen
 - receptors and macrophages
 - receptors on mast cells
 - complement
 - an epithelial cell transcytosis receptor

20. Which of the following contributes to the diversity of different antibodies produced by the body?
- A lymphocyte encounters an antigen and then tries to assemble V, D, and J gene segments until an antibody is produced that binds.
 - A lymphocyte tries lambda, kappa, gamma, alpha, and epsilon constant region segments until it finds one that binds the antigen.
 - Diversity is generated by combinatorial assembly followed by clonal selection. After exposure to antigen there is somatic mutation followed by additional clonal selection.
 - All of the above
 - None of the above
21. An inflammation triggered by kinins would most likely be caused by _____.
- an infection by a virus
 - an infection by a bacteria
 - an IgE reaction
 - an injury that breaks blood vessels
 - None of the above; kinins do not trigger inflammation.
22. The key to transitioning from the destructive phase of inflammation to the healing phase is _____.
- the ongoing formation of immune complexes
 - that the destructive phase eliminates the source of the inflammatory signal
 - effective platelet plugging
 - a continuing influx of monocytes
 - an IgE response
23. Which one of the following is most effective in inhibiting platelet plugging?
- aspirin
 - ibuprofen
 - coumidin
 - heparin
 - von Willebrand's factor
24. Which one of the following statements about the extrinsic pathway is FALSE?
- It is triggered by mixing blood-borne factor VII with tissue factor.
 - It is the pathway tested by prothrombin time (PT) or INR.
 - It is dependent on vitamin K-dependent post translational modification of several coagulation factors.
 - The extrinsic pathway is unnecessary in the presence of an intact intrinsic pathway.
 - The extrinsic pathway can be triggered in a test tube by addition of tissue factor and phospholipid.

25. What role does blood coagulation play in fighting infection?
- Fibrin enhances the functions of antibodies.
 - The clot in an exterior wound keeps out bacteria.
 - The coagulation cascade activates antibody production.
 - Fibrin collaborates with complement to kill bacteria.
 - None of the above.
26. Which pairing of a digestive organ and its function is INCORRECT?
- salivary glands : secretion of mucins
 - stomach : secretion of hydrochloric acid (HCl)
 - pancreas : synthesis and secretion of pepsinogen
 - liver : synthesis of bile salts
 - small intestine : membrane-bound amylases, such as maltases, degrade disaccharides to monosaccharides
27. Which one of the following processes relating to protein digestion and/or absorption is NOT correct?
- Histamine stimulates the secretion of hydrochloric acid; this in turn activates pepsinogen and unfolds proteins making them more accessible to digestive proteases, such as pepsin.
 - Cholecystokinin and secretin stimulate the release of fluids from the pancreas, which is rich in zymogens, such as trypsinogen.
 - Trypsinogen is activated to trypsin, which in turn activates several other zymogens.
 - Proteins are degraded by both soluble endopeptidases and exopeptidases in the lumen of the small intestine.
 - Peptides are cleaved by membrane-bound peptidases in brush border, and only after they are fully degraded to free amino acids are they absorbed by the intestinal villi.
28. Which one of the following statements is TRUE?
- Tetrahydrofolate is derived from folic acid (folate) by oxidation.
 - Tetrahydrofolate carrying a one-carbon unit in the most reduced state has nothing to do with the regeneration of methionine from homocysteine.
 - Tetrahydrofolate, carrying a one-carbon fragment in its most oxidized (least reduced) state, can be formed in a reaction in which FH_4 , ATP, and formate are substrates.
 - Tetrahydrofolate deficiencies can be tolerated under most circumstances as S-adenosyl methionine can substitute in *all* of the reactions that normally require one carbon derivatives of tetrahydrofolate.
 - All of the above.
29. What role does serine hydroxymethyl transferase play in the catalytic cycle in which thymidine-5-phosphate is synthesized?

- a. Its required in order to reduce FH_2 back to FH_4 .
- b. Its required in order to reduce $\text{N}^5, \text{N}^{10}$ -methylene FH_4 to N^5 -methyl FH_4 prior to methyl group transfer.
- c. Its required in order to regenerate one of the substrates for thymidylate synthase.
- d. All of the above.
- e. None of the above.

30. Which one of the following statements is CORRECT?

- a. Most biogenic amines are formed by deamidation.
- b. Epinephrine is derived from the amino acid histidine.
- c. Histamine is derived from the amino acid tyrosine.
- *d. Serotonin levels could be affected by a dietary deficiency in the amino acid tryptophan.
- e. All of the above.

31. Uncontrolled gout leads to a severe form of arthritis. This reflects _____.

- a. chronic inflammation leading to tissue destruction
- b. a side effect of taking colchicine
- c. a side effect of taking allopurinol
- d. an autoimmune reaction to uric acid in the joints
- e. strain on the joints from carrying excessive weight

32. Which one of the following statements concerning glycosaminoglycans is NOT true?

- a. They are highly negatively charged.
- b. Glycosaminoglycans, such as heparin, hyaluronic acid, and chondroitin sulfate, typically containing glucuronic acid, a derivative of glucose, in which C-6 has been oxidized to a carboxylic acid functional group.
- c. They are present in many types of connective tissues.
- d. They accumulate in the cytoplasm and are used for storage of metabolic energy.

33. A heterodimeric growth factor (i.e. a growth factor comprised of two different subunits) has been shown to be highly effective for treating a particular form of cancer. A biotechnology company has developed a procedure to produce the two subunits in bacteria, however when combined the biologically active growth factor is not formed. What might be happening?

- a. The solution in which the two subunits are combined may contain a reducing agent, such β -mercaptoethanol, which prevents the formation of a critical intersubunit disulfide bond.
- b. The solution in which the two subunits are combined contains high concentrations of guanidine hydrochloride.
- c. The heterodimer is normally formed but the individual subunits lack certain posttranslational modifications required for function.
- d. All of the above.
- e. None of the above.

34. Which one of the following statements is FALSE?

- a. Passive proteins generally serve a structural role while active proteins bind ligands to initiate, modify or terminate a physiological process.
- b. Some ribonucleic acids behave as biological catalysts.
- c. Increasing the temperature will increase the number of molecules of a reactant that reach the transition state per unit of time.
- d. Decreasing the energy of activation will increase the number of molecules of a reactant that reach the transition state per unit of time.
- e. Since the uncatalyzed oxidation of glucose to CO₂ and H₂O is thermodynamically favorable, then the reaction rate must be rapid.

35. Myoglobin _____ .

- a. transports O₂ and CO₂
- b. is composed of one α and one β subunits
- c. binds O₂ at the Fe²⁺ in the heme group
- d. exhibits the Bohr effect
- e. contains iron in the Fe²⁺ state in the ferrimyoglobin form

36. The binding of O₂ to hemoglobin is _____ by an increase in the concentration of H⁺ and is _____ by a decrease in the concentration of CO₂.

- a. decreased, decreased
- b. decreased, increased
- c. increased, increased
- d. increased, decreased
- e. decreased, unchanged

37. Which one of the following statements about hemoglobin is FALSE?

- a. Hemoglobin F binds 2,3-bisphosphoglycerate less tightly than does hemoglobin A.
- b. Hemoglobin S contains a valine in the 6th position in the β chain.
- c. An increase in the concentration of 2,3-bisphosphoglycerate decreases the binding of O₂ to hemoglobin A.
- d. The majority of CO₂ is transported in the vascular system to the lungs bound to hemoglobin in the form of carbaminohemoglobin.
- e. The positive cooperativity for the binding of O₂ to hemoglobin A facilitates the delivery of O₂ to metabolically active tissues.

38. Which one of the following statements comparing or contrasting collagen and alpha keratin is FALSE?

- a. Both are insoluble fibrous proteins.
- b. Synthesis of both alpha keratin and collagen are defective during vitamin C deficiency.
- c. Alpha keratin is cross linked intracellularly, whereas collagen is cross linked after secretion and deposition into an extracellular matrix.
- d. Both are represented by a gene family, with different members of the family chosen for expression in different tissues.
- e. Alpha keratin is primarily composed of alpha helix, whereas collagen is primarily composed of a three-stranded helix.

39. Which one of the following steps in collagen biosynthesis is INCORRECT?

- a. Many proline residues are hydroxylated by a specialized enzyme in the endoplasmic reticulum.
- b. After hydroxylation, procollagen is glycosylated.
- c. Triple helix formation commences after transport to the Golgi apparatus.
- d. Propeptide cleavage occurs after secretion.
- e. Type I, II, or III tropocollagen (the part left after removing the propeptides) assembles into fibrils in quarter-staggered arrays.

40. Proteoglycan aggregate is _____.

- a. the causative agent in sickle cell anemia
- b. a storage polymer found in intracellular granules
- c. the principal component of a blood clot
- d. a complex containing heparin and blood clotting factors
- e. a material forming an extracellular matrix into which collagen fibers are deposited

41. While comparing amino acid sequences of two different IgG molecules that bind to different antigens, you should expect to find that _____.

- a. they have the same amino acid sequences, but their disulfide bonds are arranged differently
- b. they have identical heavy chains, but the light chains are different
- c. they have identical light chains, but the heavy chains are different
- d. their heavy and light chains each have a segment with identical sequence and a segment with a different sequence
- e. all parts of the two molecules are different

42. Which one of the following immunoglobulin classes is CORRECTLY paired to one of its functions?

- a. IgG - stays in the circulation for a long time
- b. IgE - secreted into saliva
- c. IgE - secreted into intestinal fluid
- d. IgA - Fc region binds to mast cells
- e. IgM - crosses placenta transferring maternal immunity to a newborn child

43. Which one of the following statements concerning an immunoglobulin class switch is FALSE?

- a. DNA is rearranged.
- b. Somatic hypermutation affects variable region sequences.
- c. Clonal selection continues.
- d. Memory B lymphocytes have undergone at least one class switch.
- e. The product is an IgM molecule.

44. During inflammation, how do neutrophils and monocytes find their way into the inflamed tissue?

- a. They can only arrive by leaking out through broken blood vessels.
- b. They have receptors for specialized adhesion molecules that become displayed in capillaries of inflamed tissues.
- c. They migrate through the lymph system from the nearest lymph node.
- d. They are present in the tissue at all times and become activated during inflammation.
- e. They differentiate from resident fibroblasts.

45. Chronic inflammation occurs _____.

- a. if phagocytes fail to clear the material triggering the inflammation in a timely fashion
- b. if phagocytes are tricked into digesting each other
- c. any time there are bacteria in a wound
- d. only in tissues below the neck
- e. only if a virus is involved

46. Plavix is a new drug prescribed to patients at a high risk for heart attacks. It irreversibly inhibits a receptor on platelets blocking reception of ADP as a platelet aggregation signal. Your concerns for a patient taking this drug would be most similar to one _____.

- a. taking high doses of aspirin
- b. taking high doses of ibuprofen
- c. taking high doses of vitamin C
- d. having von Willebrand's disease
- e. having vitamin C deficiency

47. After tooth extraction, which one of the following statements is FALSE?

- a. Platelets filling the wound site will activate, send signals to each other, and become sticky.
- b. Coagulation factor complexes will form on platelet surfaces and result in cleavage of fibrinogen to make fibrin.
- c. If plasminogen is present the clot will fall apart and infection will set in.
- d. Fibronectin incorporated into the clot will act as a scaffold for migrating repair cells.
- e. Tissue plasminogen activator will eventually convert enough plasminogen to plasmin to dissolve the fibrin.

48. Which one of the following statements is TRUE for both myoglobin and hemoglobin?

- a. Is a transporter of oxygen and carbon dioxide.
- b. Is composed of two α -subunits and two β -subunits.
- c. Binds oxygen at the ferrous ion (Fe^{2+}) in the heme group and is predominantly α -helical.
- d. Oxygen binding is regulated by hydrogen ion and carbon dioxide.
- e. Undergoes structural rearrangement upon cooperative binding of oxygen.

49. Low pH, CO_2 and 2,3-bisphosphoglycerate each stabilize the _____ form of hemoglobin through formation of _____ interactions.

- a. oxy, nonpolar
- b. oxy, covalent
- c. oxy, electrostatic
- d. deoxy, polar
- e. deoxy, electrostatic

50. Which one of the following statements comparing structure and function of α keratin with collagen is FALSE?

- a. In both cases, expression of selected members of a gene family is used to govern the properties of a given tissue.
- b. Both proteins are secreted into an extracellular matrix.
- c. Both proteins are crosslinked.
- d. α keratin is mainly in an α -helical conformation whereas collagen is based on a 3-stranded helix.
- e. Neither α keratin nor collagen is found in enamel.

51. Which one of the following statements about the biosynthesis of collagen is TRUE?

- a. Three polypeptides named collagen type I, II, and III, form the basic tropocollagen molecule.
- b. Procollagen polypeptides are hydroxylated in the endoplasmic reticulum prior to formation of the triple helix.

- c. The function of the propeptides is to stimulate covalent crosslinking.
 - d. The propeptide cleavage reaction requires vitamin C as a cofactor.
 - e. The term “tropocollagen” refers to the intracellular form of collagen.
52. Which one of the following statements about proteoglycan aggregate is FALSE?
- a. Proteoglycan aggregate is a major component of ground substance.
 - b. Proteoglycan aggregate consists of proteoglycan monomers joined along a strand of hyaluronic acid by link glycoprotein.
 - c. Proteoglycan aggregate contains large amounts of glycosaminoglycans.
 - d. The glycosaminoglycans bind large amounts of water and cause proteoglycan aggregate to take up space.
 - e. Other than the link glycoprotein, there is no protein component to proteoglycan aggregate.
53. Which of the following conditions is NOT at least sometimes caused by a collagen defect?
- a. vascular fragility
 - b. osteogenesis imperfecta
 - c. bleeding around the gums
 - d. dentinogenesis imperfecta
 - e. any of the above may be caused by a collagen defect
54. Which one of the following statements about antigen presentation is FALSE?
- a. T lymphocytes require antigens to be presented by other cells in order to recognize them.
 - b. Antigen presentation is conducted by surface bound IgM molecules.
 - c. Class I presentation allows recognition of virally infected cells, whereas class II presentation may lead to antibody production.
 - d. T lymphocytes recognize presented antigens with a T cell receptor in combination with accessory molecules named CD4 or CD8.
 - e. CD4 is used by HIV to target infection of T lymphocytes.
55. Which one of the following statements about the structure and function of an IgG antibody is TRUE?
- a. An IgG molecule is composed of two identical heavy chains and two identical light chains.
 - b. A protease is used to separate the four polypeptide chains allowing assignment of function to each individual chain.
 - c. All of the IgG molecules found in the bloodstream of a patient will be the same.
 - d. All antigen contacts are with the light chain.
 - e. After secretion, IgG is not recognized by any human cells.
56. Which one of the following is a CORRECT association of function with immunoglobulin class type?
- a. IgE is found in bodily secretions where its variable region attacks parasites.
 - b. The IgA constant region targets it to lymph nodes.

- c. IgD is particularly effective at agglutination due to its multimeric structure.
 - d. The IgG constant region is recognized at the placenta, allowing it to cross and provide maternal immunity to a newborn.
 - e. IgM is unusual in that it has no variable regions.
57. Which of the following may initiate inflammation?
- a. Phagocytes recognizing antibody bound to foreign substances or recognizing bacterial cell wall with intrinsic receptors can secrete inflammatory cytokines.
 - b. IgE can trigger mast cell degranulation with release of inflammatory substances.
 - c. Kinins produced during the initiation of the intrinsic coagulation cascade act as inflammatory signals.
 - d. All of the above
 - e. None of the above
58. How do circulating neutrophils and monocytes home to inflamed tissue?
- a. The circulating cells leave the circulatory system wherever they detect high concentrations of inflammatory cytokines.
 - b. There is a different inflammatory cytokine for each tissue that tells the circulating cells where to go and leave the circulatory system.
 - c. Capillaries are stimulated by inflammatory signals to display markers that will be recognized by receptors on the circulating cells causing them to leave the circulation.
 - d. The circulating cells use surface bound IgM to detect foreign antigen and cause them to leave the circulatory system.
 - e. Circulating cells leave the circulation in all tissues in high numbers, but only stay if they encounter inflammatory signals.
59. Which one of the following is the trigger of the extrinsic coagulation pathway?
- a. Prothrombin (factor II) interacts with exposed collagen fibers.
 - b. Factor XII interacts with tissue plasminogen activator.
 - c. Factors II, VII, IX, and X interact with von Willebrand's factor.
 - d. The extrinsic pathway is triggered by molecules displayed on the surface of activated platelets.
 - e. Factor VII leaks into the tissue and interacts with tissue factor.
60. What kind of inhibitor is aspirin?
- a. competitive
 - b. noncompetitive
 - c. uncompetitive
 - d. mixed
 - e. irreversible
61. The enzyme responsible for dissolving a blood clot is ____.
- a. plasmin

- b. thrombin
- c. kinin
- d. von Willebrand's factor
- e. fibrinogen

62. Which one of the following statements about digestion and/or absorption is FALSE?

- a. Digestion is the hydrolysis of carbohydrates, proteins, lipids and nucleic acids to products that can be absorbed in the intestine.
- b. Oral amylase catalyzes the hydrolysis of both α -1,4-bonds and α -1,6-bonds in glycogen.
- c. Digestion requires both soluble and membrane-bound enzymes.
- d. Mixed micelles are composed of bile salts, monoacylglycerols, fatty acid salts, cholesterol, and fat-soluble vitamins.
- e. The major digestive function of the stomach is initiation of protein digestion.

63. Which one of the following statements about secretagogues is FALSE?

- a. A decrease in the secretion of gastrin would cause an increase in secretion of HCl in the stomach.
- b. Cholecystokinin stimulates the release of bile and pancreatic enzymes.
- c. Acetylcholine stimulates the secretion of saliva.
- d. Digestion in the stomach is dependent upon the action of gastrin and histamine.
- e. The peptide hormones secretin, vasoactive intestinal peptide, and gastric inhibitory peptide affect digestive processes.

64. All the following statements are true EXCEPT _____ .

- a. lactose intolerance is caused by an excess of lactase
- b. triacylglycerols are degraded to fatty acids and monoacylglycerols which are incorporated into mixed micelles for absorption
- c. digestive proteases do not exhibit specificity for particular proteins, but do exhibit specificity for peptides bonds of specific amino acid residues
- d. protein degradation products of amino acids, dipeptides, and tripeptides can be absorbed
- e. carbohydrates are degraded to monosaccharides that are absorbed by either facilitated transport or by active transport

65. For dinner last night, assume you ate a vegetable salad with oil and vinegar dressing and fish. The vegetable salad contained starch, the dressing contained triacylglycerols, and the fish contained protein. Which one of the following statements is FALSE?

- *a. Salivary and gastric mucins were necessary for the digestion of the starch, triacylglycerols, and protein.
- b. The starch was sufficiently digested by oral and pancreatic amylases to directly yield products for absorption.
- c. Both endopeptidases and exopeptidases were required to digest the protein.

- d. Pancreatic lipase, co-lipase, and bile salts were required for the digestion of the triacylglycerols.
- e. The mouth, stomach, small intestine, liver, gall bladder, and pancreas were directly or indirectly involved in the digestion and/or absorption of your dinner.

66. Which one of the following statements about the role of acid in caries is FALSE?

- a. Bacteria in plaque produce acid as a consequence of being required to conduct anaerobic glycolysis for energy production.
- b. Saliva contains pH buffers that can neutralize acids and protect enamel from caries.
- c. Plaque acts to delay the effect of saliva on acids produced near the enamel.
- d. The main consequence of acid in plaque is the hydrolysis of dextran.
- e. The critical pH below which caries can progress is pH 5.5.

67. Which one of the following characteristics CORRECTLY describes prostaglandins?

- a. They are fatty acids derivatives and contain 22 carbon atoms.
- b. They are linear compounds with no ring structures.
- *c. Aspirin inhibits the synthesis of prostaglandins.
- d. They are synthesized from acetyl-CoA.
- e. They are transported through the vascular system as endocrine hormones.

68. Which pair of the following steroids is CORRECTLY matched with the number of carbon atoms in their structure?

- a. bile salts – 21 and cholesterol – 27
- b. vitamin D₃ – 27 and androgens – 18
- c. estrogen – 19 and glucosteroids – 21
- d. mineralcorticoids – 21 and cholesterol - 27
- e. estrogens – 19 and vitamin D₃ - 27

69. Epinephrine _____ .

- a. acts only through the phosphatidylinositol-4,5-bisphosphate system
- *b. is synthesized from tyrosine
- c. causes the level of cyclic AMP in liver cells to decrease
- d. acts through a receptor located in the cytosol
- e. stimulates the activity of cyclic AMP phosphodiesterase

70. Formation of the appropriate hormone-receptor complex and stimulation of adenylate cyclase would be expected to _____ .

- a. stimulate glycogenolysis in the liver
- b. stimulate synthesis of saturated fatty acids

- c. stimulate synthesis of glycogen
- d. inhibit lipolysis in adipocytes
- e. stimulate synthesis of cholesterol

71. Which one of the following statements is FALSE?

- *a. Binding of insulin to its receptor results in activation of protein kinase A.
- b. Diacylglycerol and inositol-1,4,5-trisphosphate are intracellular messengers in the action of some hormones.
- c. Cyclic AMP is the intracellular messenger in the action of some hormones.
- d. Cyclic GMP is the intracellular messenger in the action of some hormones.
- e. The mechanism of action of most protein hormones involves phosphorylation of serine, threonine, or tyrosine residues on target proteins.

72. Which one of the following statements about parathyroid hormone (PTH) is FALSE?

- a. Hypoparathyroidism results in delay of tooth eruption in developing humans.
- b. Hyperparathyroidism results in decreased density of the alveolar bone.
- c. PTH is a protein hormone that binds to a membrane receptor.
- d. The PTH-receptor complex interacts with a G-protein to stimulate the activity of adenylate cyclase.
- *e. PTH acts to decrease the level of serum calcium (Ca^{++}).

73. Which one of the following statements about steroid hormones is FALSE?

- a. The receptors are usually located in the cytosol.
- b. The hormone-receptor complex interacts with a heterotrimeric G-protein.
- c. Phospholipase C is not a component in the mechanism of action.
- d. They cause a change in transcription.
- e. Hormone-responsive elements are involved in the mechanism of action.

74. A common feature in the mechanism of action of some bitter-tasting substances and some protein hormones is _____ .

- a. stimulation of phospholipase C
- b. cyclic GMP as the intracellular messenger
- c. activation of a tyrosine kinase
- d. presence of receptors in the nucleus
- e. none of the above

75. _____ is a synthetic sweetener that is not metabolized.

- a. Aspartame
- b. Neotame
- c. Monellin

- d. Acesulfame
- e. Cyclamate

76. Which one of the following statements about taste is FALSE?

- a. Monellin is a sweet-tasting protein because it is a glycoprotein.
- b. A substance that elicits a sweet taste response initially interacts with a receptor cell in a taste bud.
- c. Neural responses to taste substances are transmitted to the cerebral cortex by the facial, glossopharyngeal, or vagus cranial nerves.
- d. The five taste sensations in humans are salty, sour, sweet, bitter, and umami.
- e. The taste response may be affected by the age of the individual.

77. Which one of the following is TRUE of non-collagenous proteins in bone?

- a. They constitute over 50% of bone proteins.
- b. They originate exclusively from serum.
- c. They consist primarily of type II collagen.
- d. They are commonly glycosylated.
- e. They are never glycosylated.

78. γ -carboxylation of glutamate in Gla-proteins _____ .

- a. generally never occurs in bone-associated proteins
- b. is a vitamin K-dependent reaction
- c. results in reduced Ca^{++} binding properties
- d. occurs at a maximum of two residues per protein molecule
- e. likely is unrelated to control of bone mineralization

79. Which of following roles are attributed to bone?

- a. physical support
- b. adherence for muscles and tendons
- c. metabolic reservoir for minerals
- d. protection of organs
- e. all of the above

80. Which one of the following is the MOST common type of collagen found in bone?

- a. Type I
- b. Type II
- c. Type III
- d. Type V
- e. Type X

81. Which one of the following is TRUE regarding alkaline phosphatase?

- a. It occurs in only one splice variant.
- b. It is present at high levels during bone formation.

- c. It is associated primarily with osteoclasts.
- d. It is primarily a cell adhesion molecule.
- e. It is absent from bone cells.

82. In contrast to the osteoblast, the osteoclast _____.

- a. develops from mesenchymal cells and pericytes
- b. is generally rich in lysozymes
- c. occurs in clusters of 200-300 cells
- d. has a smooth basal membrane
- e. has a low level of acid phosphatase

83. The chemokine M-CSF (macrophage colony-stimulating factor) is key to initiating differentiation of osteoclasts in that it _____.

- a. blocks the RANK/RANKL interaction
- b. stimulates the final differentiation after RANK/RANKL effects
- c. induces differentiation of hemato-progenitors
- d. has stimulatory effects similar to osteoprotegerin
- e. is primarily secreted by mature osteoclasts

84. It has been demonstrated that osteocytes _____.

- a. are localized within bone
- b. have long cytoplasmic extensions
- c. may communicate via canaliculi
- d. are visible on sections of Haversian systems
- e. are characterized by all of the above

85. Which one of the following most CORRECTLY describes canaliculi in bone?

- a. They are signs of disturbed bone mineralization.
- b. They correspond to highly mineralized regions.
- c. They contain non-collagenous proteins, but no cell components.
- d. They contain cellular extensions and type I collagen.
- e. They contain no cellular extensions, but do contain type I collagen.

86. Which one of the following receptors are used by the osteoclast to bind bone protein and form the resorption compartment?

- a. estrogen receptors
- b. PTH receptors
- c. vitamin D₃ receptors
- d. integrin receptors

e. calcium (Ca^{++}) receptors

87. Which one of the following CORRECTLY characterizes the osteoclast life cycle?

- a. Osteoclasts differentiate from local mesenchymal precursor cells.
- b. Pre-osteoclasts express RANKL.
- c. The life span of an osteoclast lasts in excess of 3 months.
- d. The resorptive activity of an osteoclast has a duration of about 2 weeks.
- e. After resorption is completed, osteoclasts remain in bone as osteocytes.

88. For which of the following reasons may interleukin-1 (IL-1) contribute to periodontal bone resorption?

- a. It cleaves collagen independent of collagenase.
- b. It is a powerful activator of osteoclasts.
- c. It is secreted exclusively by gingival fibroblasts.
- d. It is not produced in the presence of dental plaque.
- e. It enhances dextran formation by *S. mutans*.

89. Which one of the following statements is CORRECT regarding enzymatic degradation of the organic bone matrix constituents during bone resorption?

- a. Osteoclasts synthesize collagenase but not other enzymes
- b. Enzymes are transported to the resorption compartment in secretory vesicles
- c. Enzymes translocate to the resorption compartment by passive diffusion
- d. The osteoclast enzymes generally have optimal activity at a basic pH
- e. Enzymes are released from degraded hydroxyapatite crystals.

90. During bone resorption in the osteoclast, carbonic anhydrase _____ .

- a. actively transports H^+ across the membrane to the resorption compartment
- b. cleaves partially degraded collagen inside secondary lysosomes
- c. proteolytically cleaves proteoglycans
- d. forces transcription of MMP-9
- e. catalyzes the hydration of CO_2 to form H^+

91. The process of “coupling” during bone remodeling involves which one of the following?

- a. Osteoclasts and osteoblasts act simultaneously at the same location.
- b. Osteoblast activity is required prior to osteoclast activity.
- c. Osteoclast activity precedes osteoblast activity.
- d. Lining cells initially differentiate into osteoclasts and then osteocytes.
- e. Osteocytes de-differentiate to osteoblasts that then induce osteoclast proliferation.

92. Which of the following type I collagen cleavage fragments are valid markers for bone degradation?

- a. all type I collagen cleavage fragments
- b. type I collagen pyridinoline cross-linked fragments
- c. type I collagen telopeptides without cross-linkages
- d. fragments containing the intact collagenase cleavage site
- e. glycine-free fragments of collagen

93. Parathyroid hormone levels are primarily controlled by _____ .

- a. IL-1
- b. cellular Ca^{++} receptors
- c. carbonic anhydrase
- d. the pH in the osteoclast resorptive compartment
- e. M-CSF