Biology 273 Final Examination
This is an old exam – use for practice

1. A homeostatically controlled system is one in which

    a. negative feedback changes the variable away from the original condition
    b. set points can never be reset
    c. communication between cells is unnecessary
    d. stability is the result of a balance between input and output
    e. positive feedback control is involved

2. If normal alveolar pO_2 is 100mm Hg and pO_2 in the extracellular fluid surrounding the peripheral tissues is about 40mm Hg, when arterial blood enters tissue capillaries, the blood will

    a. unload O_2 to the tissues by active transport
    b. neither load or unload O_2
    c. unload O_2 to the tissue by simple diffusion
    d. load O_2 by simple diffusion
    e. load O_2 to the RBC by active transport

3. Which of the following is not a primary lymphoid organ?

    a. lymph node
    b. thymus
    c. spleen
    d. 'a' and 'b'
    e. 'a' and 'c'

4. During the heart cycle, the pulmonary artery semilunar valve closes:

    a. when left ventricular pressure exceeds aortic pressure
    b. immediately after ventricular contraction
    c. at the start of ventricular systole
    d. when left ventricular pressure falls below left atrial pressure
    e. none of the above is correct

5. Which of the following cells are granulocytes?

    a. sucrocytes
    b. macrophages
    c. neutrophils
    d. Natural Killer cells
    e. 'b' and 'd'

6. Which of the following puts a person at risk of endocarditis?

    a. too much exercise
    b. high cholesterol
    c. low cholesterol
    d. low blood pressure
    e. none of the above

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7. When the ventilation of an individual alveolus is decreased:

    a. pCO_2 decreases inside the alveolus
    b. diffusion of O_2 across the alveolar membrane is increased to compensate
    c. the capillaries supplying the alveolus are dilated
    d. the capillaries surrounding the alveolus are constricted
    e. none of the above

8. B cells are called "B cells" because they develop in the Bone marrow of humans

    a. true
    b. false

9. Most of the oxygen transported in the blood is

    a. dissolved in the plasma
    b. bound to molecules of haemoglobin
    c. bound to bicarbonate ions
    d. bound to plasma proteins
    e. carried within leukocytes

10. Which of the following does not form part of the upper airways?

    a. larynx
    b. bronchi
    c. pharynx
    d. nose
    e. 'b' and 'c'

11. A sphygmomanometer is used for?

    a. measuring cardiac output
    b. measuring heart rate
    c. measuring blood volume
    d. measuring peripheral resistance
    e. none of the above

12. In travelling from the inferior vena cava to the pulmonary artery, a red blood cell must pass through the right atrio-ventricular valve

    a. true
    b. false

13. Graded contractions can occur in which of the following types of muscle?

    a. skeletal muscle
    b. cardiac muscle
    c. smooth muscle
    d. 'a' and 'b'
    e. 'b' and 'c'

14. The drug cocaine blocks the re-uptake of norepinephrine (NE) from the synaptic cleft. This tends to cause hyper-excitability because:

    a. the concentration of NE decreases
    b. the number of receptors increases
    c. the number of receptors decreases
    d. the concentration of NE increases
    e. 'b' and 'd'

15. Which of the following is not a feature of adaptive immunity?

    a. directed at specific invaders
    b. develops slowly
    c. inflammation is characteristic
    d. remembers past infections
    e. all of the above are features of adaptive immunity

16. Because of the dead space in the lungs:

    a. alveolar pressure never equals air pressure
    b. deeper breathing is the most important factor in ventilation efficiency
    c. deeper breathing does not effect ventilation efficiency
    d. rate of breathing is the most important factor in ventilation efficiency
    e. alveolar pressure can exceed air pressure

17. Innate and adaptive responses are completely separate mechanisms that do not interact with each other.

    a. true
    b. false

18. A patient with no arterial baroreceptor function would most likely suffer from:

    a. sustained high blood pressure
    b. hypertension
    c. more variable blood pressure
    d. heart attacks
    e. no obvious symptoms

19. Which one of the following is the correct order of components in a reflex?

    a. stimulus, effector, efferent pathway, integrating center, afferent pathway, receptor
    b. stimulus, receptor, efferent pathway, integrating center, afferent pathway, effector
    c. stimulus, receptor, afferent pathway, effector, integrating center, efferent pathway
    d. stimulus, receptor, afferent pathway, integrating center, efferent pathway, effector
    e. effector, efferent pathway, integrating center, afferent pathway, receptor, stimulus

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20. The function of the T-tubules in muscle is:

    a. storage and release of Ca^{2+}
    b. communication of end-plate potential to the SR
    c. conversion of chemical work to mechanical work
    d. recovery from contraction
    e. assisting interaction of actin and myosin

21. What type of stem cell can give rise to all blood cell types

    a. uncommitted stem cell
    b. pluripotent haematopoietic stem cell
    c. omnipotent haematopoietic stem cell
    d. progenitor cell
    e. none of the above is correct

22. Local cell-to-cell communication occurs via:

    a. paracrine hormones
    b. autocrine hormones
    c. gap junctions
    d. tight junctions
    e. none of the above

23. Why is it important that the cAMP second messenger pathway induced by epinephrine or norepinephrine not only increase the activity of the voltage gated Ca^{2+} channels, but also increase the sarcoplasmic reticulum Ca^{2+}-ATPase activity in cardiac muscle?

    a. so that the refractory period is extended
    b. so that the refractory period is shortened
    c. to prevent fatigue caused by lack of calcium
    d. to prevent tetanus caused by a lack of calcium
    e. to increase the time of Ca^{2+}–troponin binding

24. Which of the following blood cells do not have a nucleus?

    a. platelet
    b. macrophage
    c. lymphocyte
    d. all of the above do not have a nucleus
    e. none of the above do not have a nucleus

25. The genetic defect causing cystic fibrosis involves impairment of which one of the following?

    a. Na^+/K^+ active transport
    b. Cl^- transport
    c. K^+ transport
    d. Ca^{2+} homeostasis
    e. mucus production

26. The alveolar cells in the lungs are lined with a layer of water. This layer

    a. often causes lung collapse in adults due to surface tension
    b. helps keep the lungs expanded and resists collapse
    c. must contain surfactant to increase surface tension
    d. must contain surfactant to reduce surface tension
    e. must be present for diffusion of oxygen to occur

The next **three** questions (**27-29**) are based on the following scenario:

A young graduate student is eating at the lab bench, and mistakenly sprinkles the drug Tetrodotoxin on his fries instead of salt. Given that this drug inhibits voltage-gated Na^+ channels, indicate whether the following statements concerning this student are true or false

27. It will be easier for his neurons to generate action potentials

    a. true
    b. false

28. His neurons will fire less frequently, since membrane potential will be brought further away threshold

    a. true
    b. false

29. The effect on the membrane potential of his neurons could be predicted by the Nernst equation, which factors in the effects of both ion concentration and ion permeability

    a. true
    b. false

30. What do platelets stick to in order to close a blood vessel break?

    a. actin
    b. collagen
    c. factor XIII
    d. all of the above
    e. none of the above

31. Which of the following statements is untrue?

    a. 20% of the total blood volume is usually found in the pulmonary circulation
    b. the rate of blood flow through the lungs is high because it comes from all of the right ventricular output
    c. blood pressure in the lungs is lower than in the systemic circuit even though it is from all of the right ventricular output
    d. low oxygen blood leaves the heart through the pulmonary artery
    e. high oxygen blood returns to the heart through the pulmonary vein

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32. Which is greater?

    a. the solubility of oxygen in water
    b. the solubility of carbon dioxide in water
    c. both are equally soluble in water

33. An antigen can be defined as:

    a. a fragment of a protein bound by a T-cell receptor
    b. a fragment of a protein from a bacteria or virus
    c. anything which starts an immune response
    d. all of the above
    e. none of the above

34. The driving force for blood flow is a(n) _____ gradient

    a. osmotic
    b. volume
    c. pressure
    d. gravity
    e. ionic

35. The hormone epinephrine is secreted by the

    a. renal gland
    b. chromaffin cells
    c. medulla oblongata
    d. adrenal gland
    e. 'b' and 'd'

36. The P-R segment in an ECG (EKG) recording corresponds temporally (time-wise) with:

    a. the end of systole and the beginning of diastole
    b. atrial contraction
    c. semilunar valve opening
    d. atrial depolarization
    e. ventricular contraction

37. Which of the following is a feature of interferon γ (gamma)?

    a. activates macrophage
    b. slows down translation of mRNA
    c. produced by virally infected cells
    d. 'a' and 'b'
    e. 'b' and 'c'

38. Normal expiration is an active process.

    a. true
    b. false

39. Which of the following types of receptors control contractions of skeletal muscle:

    a. chemically gated
    b. stretch gated
    c. voltage gated
    d. 'a' and 'c'
    e. 'a', 'b' and 'c'

40. Which of the following is a/are symptom(s) unique to tachycardia?

    a. dizziness
    b. fainting
    c. rapid heart beat
    d. feeling light-headed
    e. 'a' and 'c'

41. Which of the following statements is untrue?

    a. the central chemoreceptors directly sense pCO_2 levels
    b. increased pCO_2 in the brain increases ventilation
    c. central chemoreceptors sense pCO_2 levels
    d. changes in pH are the primary signal for peripheral chemoreceptors
    e. all of the above statements are true

42. As plasma H^+ ion concentration increases

    a. red blood cell pH will increase causing oxygen loading to haemoglobin
    b. red blood cell pH will decrease causing oxygen unloading from haemoglobin
    c. red blood cell pH will increase, reducing oxygen unloading from haemoglobin
    d. red blood cell pH will decrease causing oxygen loading to haemoglobin
    e. none of the above

43. Inspiration occurs as a result of

    a. the ribs moving closer together due to contraction of the inspiratory intercostal muscles
    b. compression upward of the bowel and diaphragm by the abdominal muscles
    c. a downward movement of the diaphragm and an upward and outward expansion of the thoracic cavity
    d. relaxation of the diaphragm
    e. thinking too hard during a Biol 273 final exam

44. In a routine examination, some blood is taken and analyzed. The results show a high IgM level for the mumps antigen. This would indicate

    a. the person has just recovered from mumps
    b. the person is just coming down with mumps
    c. the person is allergic to mumps
    d. the person is immune to mumps
    e. 'a' and 'd'

45. Put the following sequence of events in order

1. production of a thrombus
2. tissue factor III released from cells
3. fibres reinforce platelet plug
4. activation of thrombin
5. factor XIII cross-links fibrin
6. thrombin cleaves fibrinogen

a. 1-2-3-4-5-6
b. 6-4-5-3-1-2
c. 2-4-6-5-3-1
d. 3-2-4-6-5-1
e. none of the above

46. New-born respiratory distress syndrome is the result of

a. the fact that premature infants do not have fully developed diaphragmatic muscles
b. the fact that premature infants do not have fully developed respiratory centres
c. the fact that premature infants do not synthesize sufficient surfactant in their lungs
d. the fact that premature infants have not yet acquired the breathing reflex
e. the fact that premature infants do not have type I alveolar cells yet

47. Which of the following is not a function of antibodies?

a. activate complement
b. activate B cells
c. activate NK cells
d. activate Mast cells
e. activate dendritic cells

48. Tiny Tim is a cantankerous toddler, who has just threatened his mother with a promise to hold his breath until he dies unless she gives him some candy. His mother refuses to be manipulated and watches in amusement as Tiny Tim stubbornly refuses to breath. Which of the following statements is not correct?

a. Tiny Tim will loose consciousness due to hypoxia in the brain
b. the respiratory control center in the brain has been consciously inhibited to control pulmonary ventilation
c. once unconscious, the respiratory control center will resume breathing again
d. the chemoreceptor reflexes will make it difficult to stop breathing
e. all of the above statements are correct

49. Capillaries are best described as

a. microscopic vessels in which blood exchanges material with the interstitial fluid
b. thick walled vessels which convey blood away from the heart
c. thin walled vessels which convey blood towards the heart
d. thick walled vessels which carry blood rich in oxygen
e. thin walled vessels which carry blood deficient in oxygen

50. The vascular resistance in a blood vessel is related to the:

    a. vessel's length
    b. vessel's diameter
    c. amount of friction between the vessel's lining and the blood
    d. viscosity of the blood
    e. all of the above

51. Ventolin is a drug that acts to stimulate Beta 2 (β2) adrenergic receptors. Of the following, which is the most plausible reason why ventolin is used in the treatment of asthma?

    a. it reduces airway inflammation
    b. as it is inhaled, it reduces the viscosity of air
    c. it causes smooth muscle relaxation
    d. it reduces mucous production
    e. it increases ventilation rate

For Questions **52 to 55**, pick a cell type from the following list that belongs to the appropriate functional/morphological group

    a. eosinophil
    b. B cell
    c. helper T cell
    d. chromaffin cells
    e. none of the above

52. Granulocytes A

53. Phagocytes E

54. Cytotoxic cells C

55. Antigen presenting cell B

56. Contraction is initiated by Ca^{2+} binding to troponin in

    a. skeletal muscle only
    b. cardiac muscle only
    c. smooth muscle only
    d. skeletal and cardiac muscle
    e. skeletal, smooth and cardiac muscle

57. Semilunar valves open and close because of

    a. nervous stimulation of the valves
    b. contractions of the muscles attached to the valves
    c. backflow of blood fills them
    d. changes in blood pressure in the adjacent chambers
    e. contractions of fibers attached to the valves

58. All but one of the following leads to a decrease in arterial blood pressure. Which is it?

    a. decreased peripheral resistance
    b. decreased firing of baroreceptors
    c. decreased stroke volume
    d. decreased cardiac contractility
    e. increased parasympathetic discharge to the heart

59. Grab with both hands the seat of the chair you are sitting on. Pull upwards. Which one of the following statements does NOT apply to the action you have just performed?

    a. the force you exerted was primarily active
    b. the force you applied was greater than the load
    c. this was an example of an isometric contraction
    d. there was relatively little contribution by elastic muscle elements
    e. 'a' and 'c'

60. If the membranes of the cardiac muscle cells in the SA node become less permeable to potassium (K^+) ions:

    a. the heart rate will increase
    b. the heart rate will decrease
    c. the membrane will depolarize
    d. the stroke volume will increase
    e. the intracellular concentration of Ca^{2+} ion will increase

61. Which of the following is NOT true about the affinity of haemoglobin for oxygen:

    a. decreases in blood CO_2 increase affinity
    b. increases in H^+ increase affinity
    c. decreases in temperature increase affinity
    d. increases in 2,3-diphosphoglycerate (2,3-DPG) decrease the affinity
    e. 'b' and 'c'

62. The majority of innate immune system cells are:

    a. developed in the thymus
    b. granulocytes
    c. phagocytes
    d. cytotoxic cells
    e. lymphocytes

63. Most of the carbon dioxide carried in the blood is in the form of:

    a. carbon dioxide (CO_2) dissolved in the plasma
    b. bicarbonate ions (HCO_3-)
    c. carbonic anhydrase
    d. calcium carbonate
    e. carbon dioxide attached to hemoglobin

64. Which of the following conditions would prevail in a neuron during the hyperpolarization phase of an action potential?

    a. the membrane potential is more positive than the resting cell membrane potential
    b. the membrane potential is less negative than the sodium equilibrium potential
    c. the permeability of the neuronal membrane to potassium is less than that of resting conditions
    d. rapid sodium entry into the cell is turned on
    e. membrane potential is dropping

For Questions **65 to 67**, match the final cell type with the appropriate progenitor:

    a. megakaryocyte/erythrocyte
    b. lymphoid
    c. granulocyte/macrophage
    d. monocyte
    e. none of the above

65. Basophil

66. Dendritic cell

67. Natural Killer cell

68. Comparing smooth muscle to skeletal muscle,

    a. both muscle types identical except that they vary in location in the body and in their innervation
    b. the organization of the contractile filaments in each muscle type is the same
    c. excitation-contraction mechanisms are identical in both muscle types
    d. skeletal muscles are voluntary while smooth muscles are both voluntary and involuntary in their control
    e. both muscle types exhibit calcium dependent calcium release

69. Which of the following does not affect stroke volume

    a. parasympathetic stimulation
    b. sympathetic stimulation
    c. plasma epinephrine
    d. increased end diastolic volume
    e. haematocrit

70. Which of the 5 classes of antibody is a cell surface protein with no known function?

    a. IgA
    b. IgD
    c. IgE
    d. IgG
    e. IgM

71. The average atmospheric pressure at sea level is 760 mm Hg. In dry air under these conditions, the PO_2 is 160 mm Hg. What is the PO_2 of the air within the alveoli?

    a. 760 mm Hg
    b. 160 mm Hg
    c. 120 mm Hg
    d. 100 mm Hg
    e. 40 mm Hg

For Questions **72 to 75**, match the cell type with the appropriate expression of MHC receptor types

    a. MHC class I only
    b. MHC class II only
    c. Both MHC class I and MHC class II
    d. Neither MHC class I and MHC class II
    e. I give up

72. Dendritic cell

73. T cell

74. Red blood cell

75. B cell

76. A direct connection between a nerve and each individual muscle cell is not required for which muscle types:

    a. skeletal muscle only
    b. cardiac muscle only
    c. smooth muscle only
    d. skeletal and cardiac muscle
    e. smooth and cardiac muscle

77. Which of the following refers to keeping blood within a damaged vessel?

    a. haematopoiesis
    b. haemostasis
    c. haemorrhage
    d. all of the above
    e. none of the above

78. The actual sites of gas exchange within the lungs are:

    a. bronchioles
    b. alveolar ducts
    c. pleural spaces
    d. alveoli
    e. terminal sacs

79. Which of the following is not a feature of innate immunity

a. present before pathogen is encountered
b. fast response (minutes to hours)
c. remembers past infections
d. non specific cell types and proteins
e. all of the above

80. Which of the following conditions is the result of contraction of smooth muscles around the terminal bronchioles:

a. emphysema
b. asthma
c. pneumothorax
d. cystic fibrosis
e. lung cancer

81. The depolarization for initiating a heart beat under normal conditions is delayed in the:

a. AV node
b. SA node
c. Purkinje fibres
d. the Vagus nerve
e. the bundles of His

82. All but one of the following increases heart rate.

a. sympathetic nerve discharge to the SA-node
b. cutting parasympathetic supply to the SA-node
c. enhanced acetylcholine supply to the heart
d. increased liberation of epinephrine from the adrenal medulla
e. increased slope of pacemaker potential

83. If H^+ ion concentration in blood increases, it can be removed by:

a. reacting with HCO_3^- produced by carbonic anhydrase
b. reacting with $H_2CO_3^-$ produced by carbonic anhydrase
c. binding to haemoglobin
d. none of the above
e. all of the above

84. When atrial fibrillation occurs in a resting individual:

a. ventricular filling is impaired
b. ventricular filling is not markedly impaired
c. atrial pumping is enhanced
d. blood pressure drops dramatically
e. passing out and death is likely to occur

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For questions **85 to 89**, options 'A' to 'E' may be chosen:

a. sustained maximal summation
b. calcium dependent calcium release
c. no gap junctions
d. constant muscle length
e. elastic elements do not absorb change in sarcomere length

85. Isometric contraction D
86. Smooth muscle B
87. Isotonic contraction E
88. Multi-unit smooth muscle characteristic C
89. Tetanus A

90. Which of the following does the immune system protect against?

a. bacteria
b. viruses
c. toxins
d. 'a' and 'b'
e. 'a', 'b' and 'c'

91. At a pO_2 of 400 mm Hg, normal temperature and pH, haemoglobin is saturated with oxygen

a. 10%
b. 25%
c. 50%
d. 75%
e. over 90%

92. If during exercise heart rate increased from 70 beats/min to 150 beats/min and the stroke volume increased from 70mL to 120mL per beat, the change in cardiac output will be approximately

a. 0.4L/min
b. 2.1L/min
c. 8.4L/min
d. 10.5L/min
e. 13.1L/min

93. When the thoracic cavity is at rest the pressure inside the lungs equals the atmospheric pressure, which is approximately 760mm Hg. In order for air to flow out of the lungs

a. the volume of the thoracic cavity must be reduced
b. pressure in the thoracic cavity must decrease
c. pressure in the lungs must be decreased
d. pressure in the thoracic cavity must be less than the atmospheric pressure
e. lung volume must increase and lung pressure decrease

94. For the majority of patients what are the symptoms of a valvular prolapse?

    a. shortness of breathe
    b. dizziness
    c. fatigue
    d. no obvious symptoms
    e. ‘a’ and ‘b’

95. Graded potentials:

    a. are local changes in membrane potential that occur in only one magnitude
    b. serve as short-distance signals
    c. serve as long-distance signals
    d. ‘a’ and ‘b’
    e. ‘a’, ‘b’ and ‘c’

96. Epinephrine can cause both vasoconstriction and vasodilation because

    a. it is only released at specific times
    b. it can bind to different types of receptors in different tissues
    c. it undergoes an allosteric change
    d. it can be released by either sympathetic or parasympathetic nerves
    e. it doesn’t cause both effects

97. Which of the following statements is untrue?

    a. CO_2 is carried in blood in three ways: bound to haemoglobin, dissolved in plasma, and as HCO_3^- dissolved in plasma
    b. haemoglobin binds oxygen better than it binds carbon monoxide
    c. carbonic anhydrase is found primarily in erythrocytes
    d. most CO_2 in blood is in the form of bicarbonate
    e. bicarbonate removed from RBC in exchange for chloride ions

98. Which one of the following normally carries highly oxygenated blood?

    a. pulmonary vein
    b. aorta
    c. pulmonary artery
    d. ‘a’ and ‘b’
    e. ‘a’ and ‘c’

99. Local vasoconstriction is produced by:

    a. increased plasma epinephrine
    b. increased pH
    c. decreased pCO_2
    d. decreased pO_2
    e. increased pO_2

100. Motor neurons regulate the rate and strength of cardiac contraction

    a. true
    b. false

101. Caleb is a professional bull rider in the rodeo. In the big finals competition, Caleb rode Crusher, who threw him to the ground and then stepped on his chest. Caleb is in the emergency room with a broken rib and can actually feel a piece of rib sticking through the skin and is having difficulty breathing. Caleb probably is suffering from

    a. a collapsed trachea
    b. an obstruction in the bronchi
    c. a pneumothorax
    d. decreased surfactant production
    e. a bruised diaphragm

102. Angiogenesis refers to

    a. an examination of the arteries and veins
    b. having blood drawn into a tube for tests
    c. surgical restructuring of the coronary arteries
    d. collection of amniotic fluid from the uterus
    e. the growth of new blood vessels

103. One of the major differences among skeletal muscle fibre types is their resistance to fatigue. The fibres with the most endurance rely on _____ for energy

    a. anaerobic glycolysis
    b. oxidative phosphorylation
    c. lactic acid accumulation
    d. ketone body degradation
    e. none of the above

104. A fluid sample contains a large amount of IgA type antibody. This fluid is probably

    a. blood
    b. lymph
    c. serum
    d. tears
    e. intracellular

105. The chloride shift occurs when

    a. hydrogen ions leave the red blood cells
    b. bicarbonate ions leave the red blood cells
    c. hydrogen ions enter the red blood cells
    d. bicarbonate ions enter the red blood cells
    e. ‘b’ and ‘d’

106. When adenyl cyclase is activated,

    a. calcium ions are released from intracellular stores
    b. cAMP is broken down
    c. cAMP is formed
    d. protein kinases are metabolized
    e. steroids are produced

107. Bill wants to determine his blood type, so he takes a few drops of blood from a puncture wound in his finger and mixes it with various antisera. His blood cells agglutinate when mixed with the anti-A serum but not with the anti-B serum. This means

    a. Bill could receive type B in a transfusion
    b. Bill could donate blood to an individual with type B blood
    c. Bill is Rh positive
    d. Bill's plasma contains B antibodies
    e. Bill's plasma would cross-react with type O red blood cells

108. The brief period of time between the end of the action potential in the muscle and the beginning of contraction is referred to as

    a. the refractory period
    b. the latent period
    c. the relaxation phase
    d. the depolarization phase
    e. the repolarization period

109. Type II alveolar cells

    a. synthesize lipoproteins such as dipalmitoylphosphatidylcholine
    b. allow rapid diffusion of gases through their thin membranes
    c. secrete a chemical known as surfactant
    d. are phagocytic
    e. 'a' and 'c'

110. Which of the following is not true regarding platelets

    a. are also called thrombocytes
    b. arise from cells in the bone marrow
    c. are derived from huge cells called megakaryocytes
    d. are smaller than red blood cells and have no nucleus
    e. all of the above are true regarding platelets

111. When a person rises quickly from a horizontal (prone) position

    a. the carotid baroreceptors increase firing
    b. venous return is increased
    c. reflex vasoconstriction of peripheral blood vessels occurs
    d. heart rate decreases
    e. 'a' and 'c'

112. Chemotaxins function in

    a. digesting invading cells
    b. attracting additional immune cells
    c. marking or tagging pathogens so phagocytes can find and ingest them
    d. poisoning and killing invading cells
    e. 'b' and 'c'

113. The sum of the tidal volume, plus the inspiratory and expiratory reserve volumes is the

    a. residual volume
    b. total lung capacity
    c. tidal capacity
    d. vital capacity
    e. none of the above

114. Milly has just received a kidney transplant and is taking cyclosporin A, a drug that suppresses cytotoxic T cells. What does this medication do?

    a. prevents inflammation from destroying the transplanted kidney
    b. depresses haematopoiesis
    c. prevents rejection
    d. increases the number of antibodies in the blood
    e. 'a' and 'c'

115. If a hyperpolarizing graded potential and a depolarizing graded potential of the same magnitude arrives at the trigger zone at the same time, what happens?

    a. an action potential is fired off more quickly than usual
    b. the cell becomes hyperpolarized
    c. the cell becomes depolarized
    d. an action potential will fire at normal rate
    e. nothing will happen

116. The following are steps involved in transmission at a cholinergic synapse

    1. acetylcholine binds to receptors on the post synaptic membrane
    2. chemically regulated ion channels on the postsynaptic membrane are activated
    3. calcium ions enter the axon terminal
    4. an action potential depolarizes the axon terminal at the presynaptic membrane
    5. acetylcholine is released from storage vesicles by exocytosis

    The correct sequence for these events is

    a. 5, 2, 1, 3, 4
    b. 1, 2, 3, 4, 5
    c. 4, 3, 5, 1, 2
    d. 2, 3, 5, 1, 4
    e. 3, 5, 1, 2, 4

117. Which of the following conditions would have the greatest effect on peripheral resistance?

    a. doubling the length of a vessel
    b. doubling the diameter of a vessel
    c. doubling the viscosity of the blood
    d. doubling the turbulence of the blood
    e. none of the above

118. The dorsal respiratory group

    a. are the inspiratory neurons
    b. control the diaphragm
    c. control the external intercostal muscles
    d. ‘a’ and ‘b’ only
    e. ‘a’, ‘b’ and ‘c’

119. Lymphocytes are located in each of the following tissues or organs except one. Identify the exception

    a. spleen
    b. lymph nodes
    c. brain
    d. thymus
    e. lymphocytes are found in all of the above

120. In cardiac muscle,

    a. calcium ions are not released from the sarcoplasmic reticulum
    b. calcium ions do not bind to troponin
    c. calcium ions play no role in the process of contraction
    d. some of the calcium ions required for contraction comes from outside the cell
    e. calcium ions plays an important role in repolarizing the membrane after the depolarization phase

121. Colony stimulating factors are cytokines made by

    a. endothelial cells
    b. fibroblasts from bone marrow
    c. leukocytes
    d. ‘a’ and ‘b’
    e. ‘a’, ‘b’ and ‘c’

122. Diffuse lymphoid tissues include

    a. tonsils
    b. gut associated lymphoid tissue (GALT)
    c. spleen
    d. ‘a’ and ‘b’
    e. ‘a’, ‘b’ and ‘c’

123. The power stroke begins when

    a. the actin is released by the myosin head
    b. the ATP is hydrolyzed by the myosin head
    c. the inorganic phosphate and ADP are released from the myosin
    d. the actin is attached to the myosin head
    e. ‘a’ and ‘b’

124. Each of these is a true statement except one. Identify the exception

a. each neurotransmitter is degraded by a specific enzyme and its components recycled to the presynaptic cell
b. polypeptide neurotransmitters must be synthesized in the cell body and transported to the axon terminal
c. nitric oxide functions as a neurotransmitter but diffuses freely into the target cell
d. some neurotransmitters are synthesized in the axon terminal, rather than the cell body
e. each of these is a true statement

125. Which of the following use gap junctions?

a. muscle cells of the heart
b. skeletal muscle cells
c. endothelial cells of blood vessels
d. axon terminals
e. all of the above

126. Alveolar ventilation refers to

a. the movement of air into and out of the lungs
b. the movement of air into and out of the alveoli
c. the movement of dissolved gases from the alveoli to the blood
d. the movement of dissolved gases from the blood to the alveoli
e. 'c' and 'd'

127. All of the various macrophages are derived from

a. lymphocytes
b. neutrophils
c. eosinophils
d. monocytes
e. basophils

128. Put these events in the correct chronological sequence

1. end plate potentials trigger action potentials
2. transverse tubules convey potentials into the interior of the cell
3. acetylcholine binds to receptors on the motor end plate
4. binding sites on actin are uncovered, allowing myosin to bind and carry out power strokes
5. Ca^{2+} is released from sarcoplasmic reticulum
6. chemically regulated ion channels open, causing depolarization
7. Ca^{2+} ions bind to troponin, pulling on tropomyosin

a. 5, 3, 2, 1, 4, 7, 6
b. 3, 6, 1, 2, 5, 7, 4
c. 4, 1, 3, 7, 2, 6, 5
d. 2, 4, 7, 6, 3, 1, 5
e. 3, 6, 1, 5, 7, 2, 4

Name: _____ ID: _____

129. Differences between autorhythmic myocardial cells and contractile myocardial cells include

    a. autorhythmic myocardial cells depend on Ca^{2+} for depolarization
    b. autorhythmic myocardial cells have I_f channels
    c. autorhythmic myocardial cell action potentials do not have a plateau phase
    d. 'b' and 'c'
    e. 'a', 'b' and 'c'

130. An inflammatory response is triggered when

    a. red blood cells release pyrogens
    b. T lymphocytes release interferon
    c. mast cells release granules containing histamine and heparin
    d. neutrophils ingest bacteria by phagocytosis
    e. blood flow to an area increases

***** ***Bonus Question*** *****

131. You needed to re-examine the living creature on Mars that you had previously encountered! You still find that it has cells that resemble neurons and an electrode records a trace that is remarkably similar to an action potential (see Figure 1 below). But when you measure ion concentrations around the neuron, there is a strange absence of either sodium or potassium. Instead, there is high levels of Rubidium (Rb^+), Cesium (Cs^+), and Iodine (I^-). You measure the ion concentrations and calculate the equilibrium potential for each ion. E_{ion} is +160mV for Cesium**,** -20mV for Iodine and –85mV for Rubidium. Which ion is responsible for the repolarization phase of the alien action potential

    a. rubidium
    b. cesium
    c. iodine
    d. 'a' and 'b'
    e. none of these ions can account for membrane repolarization

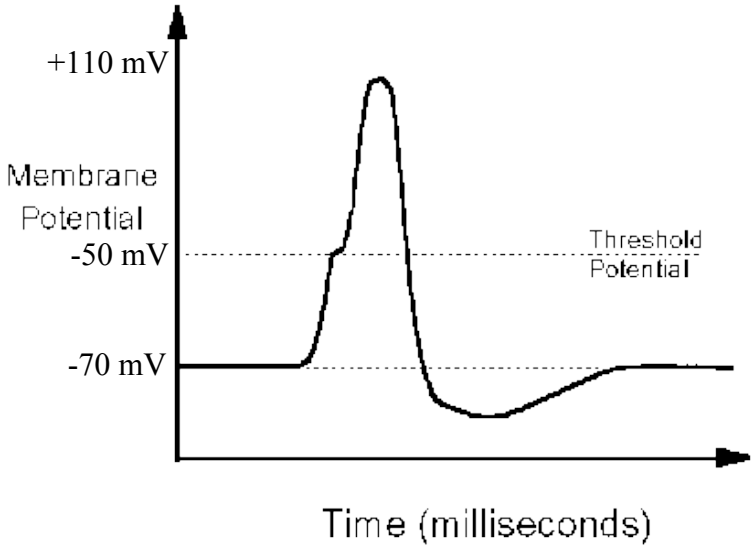

Figure 1
Action potential recorded from neuron-like cell of Martian specimen 309

Collected: Olympus mons
Date: April 11th, 2505

******** ***Have a great summer!*** ********