BIOC 4009 Midterm Exam **2012-13**

Part A Multiple Choice (1 mark each) **Name: _____**

Student number:_____

1. Which of the following cations is much more abundant in blood plasma compared to intracellular concentrations?

A) Ca^{+2} B) K+ C) Na+ D) Mg^{+2}

2. Which of the following statements about sickle cell disease **is not** correct?

A) Hemoglobin S (HbS) can undergo reversible polymerization when oxygenated.

B) The long HbS polymers distort the erythrocyte and damage cell membranes.

C) The resulting sickle shaped cells have a shorter life span and undergo hemolysis.

D) Erythrocyte lysis in the vascular system releases arginase which lowers nitric oxide (NO).

3. Which of the following statements about fibrinogen **is not** correct?

A) it is a soluble, fibrous glycoprotein

B) it consists of an assembly of 2 copies of a 3-subunit molecule

C) fibrin is generated by thrombin cleavage of fibrinogen

D) fibrin strands are cross-linked by prekallikrein

4. The clotting factors II, VII, IX & X are carboxylated by gamma-glutamyl carboxylase in a reaction that also converts vitamin K to its epoxide form. A second enzyme, vitamin K epoxide reductase (VKOR), recycles vitamin K epoxide back to vitamin K. Which of the following is an inhibitor of VKOR?

A) Factor VIII C) Polyphosphate

B) Prekallikrein D) Warfarin

5. Which of the following is the most abundant component of formed elements (cells) in blood?

A) erythrocytes C) basophils

B) leukocytes D) monocytes

6. Which of the following therapies used to treat Hemoglobin S (HbS) disease results in increased expression of the fetal HbF form?

A) Aspirin C) Factor Xa

B) Hydroxyurea D) Warfarin

7. The blood disorders known as β-thalassemias are the result of reduced or absent synthesis of the β-globin chains. Which of the following is the most common cause of this class of thalassemias?

A) usually a result of point mutations affecting mRNA synthesis

B) usually a result of errors in translation

C) usually a result of a failure to secrete β subunits

D) usually a result of the degradation of β globins by thrombin

8. Under what circumstances would an individual's NK cells normally attack their own cells?

A) If the cells have been infected by a virus and display 'non-self' antigens along with MHC I.

B) If the cells have been infected by a virus and only display 'self' antigens along with MHC I.

C) If the cells have been infected by a virus and only display the T cell receptor.

D) If the cells have been halted in G_0 of the cell cycle and are in a quiescent state.

9. Which of the following **is not** one of the initiating events of atherosclerotic plaque formation?

A) Elevated LDL particles accumulate in the arterial wall and are oxidized & glycated.

B) The modified LDLs stimulate endothelial cells to which latch onto monocytes and T cells.

C) Cytokine signaling stimulates the immune cells to migrate into the intimal layer.

D) The T cells mature into macrophages and begin phagocytosis of the modified LDL particles.

10. Which of the following **is not** one of the acute care treatments of atherosclerotic thrombosis?

A) tissue plasminogen activator(tPA) C) Streptokinase (SK)

B) transglutaminase (TG) D) Urokinase (UK)

11. Which of the following **is not** one of the usual organic wastes excreted by kidneys?

A) Albumin B) Urea C) Creatinine D) Uric acid

12. Which of the following **is not** one of the recognized functions of the liver?

A) Synthesis of most circulating proteins

B) Degradation (and excretion) of amino acids

C) Carbohydrate metabolism

D) Synthesis of most circulating glucagon

13. Which of the following **is not** a characteristic of liver undergoing cirrhosis?

A) The necrosis of hepatocytes in sections of liver tissue.

B) Inflammation and fibrosis resulting in ECM accumulation.

C) Deposition of extracellular actin fibers by activated stellate cells.

D) Nodule formation by regenerating hepatocytes in collagen matrix.

14. Which of the following is not one of the characteristics of Fibronectins (Fn)?

A) Abundant adhesive glycoproteins found in tissue matrices and circulating in body fluids.

B) Fibronectins interact with cell surface receptors (Integrins).

C) Interaction with integrins causes Fn molelcules to fold into spheres.

D) Fibronectin binding regulates the activity of cells to which they are attached.

15. Which of the following **is not** one of the enzymes humans use to degrade ethanol?

A) Alcohol dehydrogenase C) cytochrome P-450E1 (CYP2E1)

B) Alcohol kinase D) mitochondrial catalase

16. Which of the following toxic metabolites is generated by the degradation of ethanol?

A) Acetaldehyde
B) Antabuse
C) Acetyl-CoA
D) Pyruvate

17. Which of the following **is not** secreted by the pancreas?

A) insulin B) glucagon C) ADH D) somatostatin

18. Under normal conditions, approximately how much glucose is metabolized each day by adult humans?

A) 2 g B) 20 g C) 200 g D) 2000 g

19. Which of the following statements about the insulin maturation pathway **is not** correct?

A) Insulin is first translated into a prepropeptide
B) Insulin is processed by removal of the C-peptide within mitochondria
C) Insulin propeptide undergoes disulphide bond formation within the ER
D) Insulin moves from the Golgi to the cell surface in secretory vesicles

20. Which of the following best describes the structure of the K_{ATP} channel in β-cell membranes?

A) Monomer of Kir6.2 & Sur1
B) Dimer of Kir6.2 & dimer of Sur1
C) Dimer of Kir6.2 and tetramer of Sur1
D) Tetramer of Kir6.2 & Sur1

21. Which of the following statements about Type II Diabetes **is not** correct?

A) usually a late onset illness (> 30 yrs of age)
B) usually diagnosed in overweight individuals
C) usually associated with HLA DQ2 or DQ8
D) usually associated with insulin resistance

22. Which of the following is suspected of being the initial triggering event in the development of Type I diabetes?

A) infection by influenza virus
B) infection by enterovirus
C) exposure to glucagon
D) exposure to somatostatin

23. Which of the following statements about the Major Histocompatibility Complex (MHC) **is not** correct?

A) The MHC genes are scattered on multiple chromosomes.
B) The MHC genes are generally well conserved between species.
C) The MHC proteins are responsible for rejection reactions in tissue transplants.
D) The MHC proteins present foreign antigens to T cell, surface receptors.

24. Which of the following types of enzymes modifies the α-gliadin epitope to increase the binding affinity to HLA-DQ2?

A) glutamate dehydrogenase
B) transglutaminase
C) glutamine synthase
D) transketolase

Bonus

25. Ishimotoa, T. *et al.* (2012) Studied the effects of high fructose consumption in WT mice and KHK-A/C knockout (KO) mice. Fructose-induced metabolic syndrome is prevented in mice lacking both A & C isoforms of fructokinase (ketohexokinase). In mice lacking only fructokinase A, the onset of metabolic syndrome was:

A) partly prevented
B) prevented completely
C) the same as wild type
D) more severe than wild type

Part B Answer any 4 of the following questions (4 marks each)

1. Using diagrams, briefly describe how the concentration of glucose controls the release of insulin from β-cells. How do the sulfonylurea drugs work in this control system?

2. Using diagrams, describe the extrinsic activation pathway for apoptosis. What types of cellular proteins are targeted by this pathway?

3. Using diagrams, describe how persistently high levels of glucose damage the circulatory system and tissue organs such as the heart, kidney and liver (Hint: AGEs). Note: detailed chemical structures are not necessary.

4. Using diagrams, briefly describe how mutations in the Polycistin-1 gene result in the formation of cysts along the kidney tubules?

5. Using a diagram, briefly describe how micro RNAs (miRNAs) are formed and how they function. What role are miRNAs thought to play in adult onset diabetes?