



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN CELL AND MOLECULAR BIOLOGY

SBC 212: CELL SURFACE AND INTRACELLULAR COMMUNICATION

DATE: Monday 26th March, 2012

TIME: 4.30 p.m. – 6.30 p.m.

SECTION A: ANSWER ALL QUESTIONS (20 MARKS)

1. All the following statements about monomeric G proteins are true except
 - A) They are regulated by GTP-GDP exchange proteins
 - B) They are regulated by GTPase activating proteins
 - C) They regulate enzymes that synthesize cGMP
 - D) They regulate vesicle formation
 - E) They regulate vesicle fusion
2. Which of the following is NOT a consequence of increased cellular levels of cAMP?
 - A) Activation of a kinase cascade
 - B) Activation of the transducin G-protein
 - C) Increased phosphorylation of glycogen phosphorylase
 - D) Inhibition of glycogen synthesis
 - E) Dissociation of the cAMP-dependent protein kinase tetramer²⁸
3. Rhodopsin, -adrenergic receptors, and muscarinic acetylcholine receptors share which of the following features?
 - A) Each causes an inhibitory intracellular response.
 - B) Each activates a tyrosine kinase cascade.
 - C) Each is composed of a dimer.

- D) Each functions through a heterotrimeric G-protein.
 - E) Each gates a cation channel.
4. Which of the following cell junctions is responsible for metabolic coupling?
- A) Tight junction
 - B) Gap junction
 - C) Adherens junction
 - D) Desmosome
 - E) Hemidesmosome
5. Which of the following events occur first as a result of EGF binding to its receptor?
- A) Activation of a serine/threonine kinase
 - B) Activation of a tyrosine phosphatase
 - C) Activation of a tyrosine kinase
 - D) Activation of a phospholipase
 - E) Activation of a GTPase
6. Which among the following cellular structures serve similar functions in plants and animals, respectively?
- A) Tight junctions Gap junctions
 - B) Desmosomes Gap junctions
 - C) Plasmodesmata Gap junctions
 - D) Plasmodesmata Desmosomes
 - E) Plasmodesmata Tight junctions
7. Increased calcium influx across the membranes of presynaptic neurons has which of the following effects on synaptic transmission?
- A) Increased release of neurotransmitter
 - B) Increase in voltage-dependent potassium efflux
 - C) Decreased release of neurotransmitter
 - D) Decrease in voltage-dependent potassium efflux
 - E) Closure of the acetylcholine-gated channel

8. Which one among the following is not characteristic of signal transduction?

- A) Signal specificity
- B) Signal sensitivity
- C) Signal amplification
- D) Signal affinity
- E) Signal desensitization

9. What is common between the structure of a B-cell receptor and a neonatal F_C receptor

- A) They both have a membrane bound immunoglobulin
- B) They both have integral proteins
- C) They both have a peripheral protein attached
- D) The proteins are found on B-cells and T-cells
- E) They both have two cytoplasmic tails each

10. F_C receptors are responsible for

- A) Movement of antibodies across cell membranes
- B) The transfer of IgG from mother to fetus across the placenta
- C) Acquisition of antibody by many cell types
- D) All of the above
- E) None of the above

11. The immunoglobulin-fold domain stretches 110 amino acids arranged into _____ of anti-parallel strands with invariant _____ bonds that close a _____ spanning 50-70 residues

- A) Helices, intra-chain amino acid, subunit
- B) Pleated sheets, intra-chain disulfide, loop
- C) Domains, inter-chain sulfide, motif
- C) Motifs, inter-chain disulfide, domain
- E) Helices, inter-chain hydrogen, loop

12. Membrane potential is built by Na^+K^+ ATPase transporting _____ out of the cell for every _____ carried in to the cell.

A) 3 Na^+ , 2 K^+

B) 3 K^+ , 2 Na^+

C) 3 Na^+ , 3 K^+

D) 2 Na^+ , 2 K^+

E) 2 Na^+ , 3 K^+

13. What is the role of phosphorylation in visual signal transduction?

A) It sensitizes the protein rhodopsin to light

B) It desensitizes the protein rhodopsin to light

C) Activates the protein rhodopsin kinase

D) It inactivates the protein transducin

E) It facilitates disassociation of arrestin from rhodopsin

14. Chronic bronchitis due to cigarette smoking is caused by

A) Dysfunctional tight junctions

B) Movement of integral proteins between the apical and basolateral surfaces of cells

C) Presence of gap-junctions in the lung cells allowing passage of water soluble molecules

D) Overexpression of claudin proteins in lung epithelial caused by the smoking

E) Bacteria or viruses that interfere with the cell membrane integrity

15. Tumour metastasis can be caused by loss of functioning

A) Adherens junctions

B) Epithelial desmosomes

C) Hemidesmosomes

D) Occluding junctions

E) Actin filaments

16. The _____ control the binding of white blood cells to the endothelial cells lining blood vessels.

A) Cadherins

B) Selectins

C) Claudins

C) Integrins

E) Catenins

17. Which statement does not reflect a true difference between Class I and Class II MHC molecules?

A) The assembled molecules have two heteromeric polypeptide chains

B) The nature of the peptide binding cleft is open in one molecule and closed in the other

C) The molecules present antigenic peptide with distinct but well defined anchor residues

D) The bound peptide is extended and arched in one molecule but extended and flat in the other

E) The antigen presenting domains lie either on separate polypeptides or distinct motifs within one of the polypeptide chains

18. Which among the following membrane proteins is completely extracellular?

A) $\alpha\beta$ TCR monomer

B) mIg of BCR

C) $\alpha 2$ -microglobulin

D) Neonatal F_C receptor

E) Insulin receptor tyrosine kinase

19. The mechanism of insulin signaling involves all of the following proteins except

A) SRF

B) Ras

C) Grb2

D) MEK

E) Raf-1

20. All of the following molecules serve as secondary messengers except

A) Cyclic AMP

B) Cyclic GMP

C) Calmodulin

D) Calcium

E) Phosphoinositide

SECTION B: ANSWER ALL QUESTIONS (5 MARKS EACH)

1. Indicate whether each of the following statements is true or false. Explain your answer

(1 Mark Each)

- i. A monoclonal antibody specific for β 2-microglobulin can be used to detect both classes of MHC molecules on the surface of cells.
- ii. Antigen-presenting cells express both class I and class II MHC molecules on their membranes.
- iii. Class II MHC molecules typically bind to longer peptides than do class I molecules.
- iv. All cells express class I MHC molecules
- v. The majority of the peptides displayed by class I and class II MHC molecules on cells are derived from self-proteins

2. Draw diagrams illustrating the general structure and the signaling domains, of a BCR and TCR-CD3 complex. (5 Marks)

3. Describe signal termination during visual signal transduction (5 Marks)

4. Compare and contrast the G proteins Gs and Ras? (5 Marks)

5. Describe the anchoring an antigenic peptide to Class I and Class II MHC molecules (5 Marks)

6. Examination of a newly born infant detected too much IgGs in the blood stream. With your understanding of intracellular communication and cell biology, what could have happened to the new born during gestation? (5 Marks)

SECTION C: ANSWER ANY TWO QUESTIONS (10 MARKS EACH)

1. Describe the structure and mode of action of the acetylcholine receptor

2. Outline the signalling mechanism of the TGF β peptide hormone

3. Using illustrations, explain how cholera and pertussis toxins manifest disease symptoms

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