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University Examinations 2023/2024

FOURTH YEAR SECOND SEMESTER EXAMINATION FOR THE DEGREE OF
BACHELOR OF SCIENCE IN MEDICAL MICROBIOLOGY

HMM 3427: CANCER MECHANISMS AND THERAPEUTICS

DATE: APRIL 2024

TIME: 2 HOURS

INSTRUCTIONS:

- (i) The paper consists of **Three** Sections
- (ii) Section A: Multiple Choice Questions
- (iii) Section B: Short Answer Questions
- (iv) Section C: Long Answer Questions

SECTION ONE: MULTIPLE CHOICE QUESTIONS (20 MARKS)

1. Which of the following statements regarding enzymes is true?
- A. Enzymes decrease the free energy change of a reaction.
 - B. Enzymes increase the rate of a reaction.
 - C. Enzymes change the direction of chemical reactions.
 - D. Enzymes are permanently altered by the reactions they catalyze.
2. What is the correct order for these events in the interaction of a cell with a signal? (1) alteration of cell function; (2) signal binds to receptor; (3) signal released from source; (4) signal transduction.
- A. 1234
 - B. 2314
 - C. 3214

- D. 3241
3. Which of the following is not a second messenger for signal transduction?
- A. Nitric oxide gas
 - B. ATP
 - C. cyclic AMP
 - D. Diacylglycerol
4. Which of the following is not a consequence of signal binding to a receptor?
- A. Activation of receptor enzyme activity
 - B. Diffusion of receptor in the plasma membrane
 - C. Change in conformation of the receptor protein
 - D. Breakdown of the receptor to amino acids
 - E. Release of the signal from the receptor
5. The following are characteristics of cell signaling EXCEPT
- A. Amplification
 - B. Specificity
 - C. Transduction
 - D. Sensitivity
6. Apoptosis
- A. occurs in all cells.
 - B. involves the cell membrane dissolving.
 - C. does not occur in an embryo
 - D. involves a series of programmed events for cell death.
7. Which statement about the cell cycle is not true?
- A. It consists of mitosis and interphase.
 - B. The cell's DNA replicates during G₁.
 - C. A cell can remain in G₁ for weeks or much longer.
 - D. Proteins are formed throughout all subphases of interphase.
8. The mechanism through which Ras becomes an oncogenic protein is which one of the following?
- A. Ras remains bound to GTP.
 - B. Ras can no longer bind cAMP.

- C. Ras has lost its GTPase activity.
- D. Ras can no longer bind GTP.
9. The ability of a normal cell to become a cancer cell can occur via a variety of mechanisms. Which one of the following best describes such a mechanism?
- A. Tumors arise via the acquisition of the ability to metabolize glucose at a faster rate than noncancer cells.
- B. Clonal expansion allows for a cell with a single mutation to become a cancer cell.
- C. Mutations in proto-oncogenes can lead to uncontrolled cell growth.
- D. Virtually all tumors arise via recombination events, leading to the formation of unusual and novel genes.
- E. Normal cellular oncogenes are mutated to proto-oncogenes, which leads to uncontrolled cellular proliferation.
10. Loss of both p53 protein alleles is found in >50% of human tumors. Which one of the following is a function of the p53 protein?
- A. Halting replication in cells that have suffered DNA damage
- B. Targeting repaired cells to undergo apoptosis
- C. Stimulating cyclin production
- D. Stimulating CDK production
- E. Stimulating phosphorylation of RI)
11. A tumor-suppressor gene is best described by which one of the following?
- A. A gain-of-function mutation leads to uncontrolled proliferation.
- B. A loss-of-function mutation leads to uncontrolled proliferation.
- C. When it is expressed, the gene suppresses viral genes from being expressed.
- D. When it is expressed, the gene specifically blocks the G1/S checkpoint.
- E. When it is expressed, the gene induces tumor formation.
12. Inheriting a mutation in an enzyme necessary for DNA mismatch repair requires which one of the following to occur before a cell loses its ability to regulate its own proliferation?
- A. A mutation in BRCA1 or BRCA2
- B. A mutation on one p53 gene
- C. A mutation in the ras gene

- D. A mutation in the corresponding normal allele
13. A tumor was found in which altered expression of a miRNA led to uncontrolled cellular proliferation. If the target of this miRNA was the Myc protein, how best would this miRNA be characterized?
- A. As an oncogene
 - B. As a dominant-negative effector
 - C. As a tumor suppressor
 - D. As a regulatory factor for an enzyme important in DNA repair
14. A 3-year-old girl is seen by a pediatric ophthalmologist because of reduced vision within her left eye. The doctor soon detects a mass growing within the eye, which is blocking her vision. Analysis of DNA from the girl's blood cells indicates a mutation in a tumor suppressor gene which, when mutated, most often leads to tumor formation within the eyes. Which one of the following is a description of how this tumor-suppressor gene regulates the cell cycle?
- A. It encodes for a cyclin.
 - B. It encodes for a CDK.
 - C. It encodes a protein that regulates the transition from G₀ to G₁ phase in the cell cycle.
 - D. It encodes a protein that regulates the transition from G₁ to S phase in the cell cycle.
15. Which of the following traits is not common to many cancer cells?
- A. uncontrolled growth and division
 - B. increased mobility
 - C. absence of a cytoskeleton
 - D. decreased adhesion to other cells
16. Which of the following molecules, when present in its normal, functional form, does not help slow down the cell cycle?
- A. p53
 - B. 1321
 - C. ATM
 - D. cyclin B1
17. Tumours are classified by
- A. damaged cell weight

- B. tissue or cell origin
 - C. ability to spread
 - D. none of these
18. Carcinomas are tumors arising from
- A. epithelial tissue
 - B. bone
 - C. muscle
 - D. connective tissue
19. Rb is a major control element of the cell cycle. It normally becomes
- A. Transcriptionally induced at the G1 checkpoint
 - B. Dephosphorylated at the G1 checkpoint
 - C. Phosphorylated at the G1 checkpoint
 - D. Phosphorylated at the G2 checkpoint
20. Cancer is more common in older people because
- A. their immune systems have degenerated
 - B. the supply of certain hormones declines with age
 - C. a change in the rate of cell replacement takes place
 - D. they have accumulated more mutations

SECTION B: SHORT ANSWER QUESTIONS (40 MARKS)

1. Outline four cancers caused by viruses and indicated their causative agent (5 marks)
2. Describe how oncogene and tumor suppressor genes and their function change in tumor cells (5 Marks)
3. Describe the different stages and the checkpoints in a typical cell cycle. (5 marks)
4. Distinguish between a benign and a malignant tumor (5 marks)
5. Explain the ways in which mutations can convert a proto-oncogene to an oncogene (5 marks)
6. Describe the modes of action of P53 tumor suppressor gene (5marks)

SECTION C: LONG ANSWER QUESTIONS (40 MARKS)

1. Describe the mechanisms involved in development of colorectal cancer (20 marks)
2. Describe the therapeutic targets of cancer drugs (20 marks)

3. Explain personalized medicine in cancer therapeutics

(20 marks)