KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2011/2012

SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE IN BIOCHEMISTRY AND BIOTECHNOLOGY

SBC 216: CELL CYCLE

DATE: Tuesday 27th March 2012 **TIME: 8.00a.m – 10.00a.m**

INSTRUCTIONS:

SECTON A: Answer All Questions (20 Marks)

1. Which of the following events does NOT occur in Prophase?
   - **A.** Condensation of the chromosomes
   - **B.** Disintegration of the nuclear membrane
   - **C.** Centromere breaking
   - **D.** Formation of the spindle apparatus

2. Cytokinesis will usually begin during anaphase with the formation of the _____as actin filaments contract the cell like tightening a belt around the middle.
   - **A.** cleavage furrow
   - **B.** spindle apparatus
   - **C.** spindle shaft
   - **D.** MTOC

3. Bacteria divide by _____ in which the single chromosome replicates and the copies are pulled apart as the cell grows, following which a new cell wall grows in between the chromosomes.
   - **A.** Fragmentation
   - **B.** Binary fission

C. Amitiosis

D. Amieosis

4. The contractile ring that drives the formation of the cleavage furrow during animal cell division is composed of

A. actin and myosin

B. microtubules.

C. intermediate filaments.

D. Microfilaments

5. During the S stage of the cell cycle, the cell

A. undergoes cytokinesis

B. undergoes meiosis

C. replicates its DNA

D. undergoes mitosis

6. Which of the following is NOT a function of apoptosis?

A. to elimate excess cells to carve out a functional structure

B. to aid in "self-nonself" recognition

C. to destroy cells that could possibly grow uncontrollably

D. All of the above are functions of apoptosis.

7. Which of the following is not a checkpoint for cell cycle control in a eukaryotic cell?

A. G_1/S

B. G_2/M

C. Spindle

D. MPF

8. Which one of the following represents interphase?

A. $G_1 + G_2 + S$

B. S + M + C

C. cytokinesis + mitosis

D. $G_0 + G_1 + G_2$

9. A cell biologist is conducting a karyotype procedure on alligator red blood cells. Exactly what does this mean?

A. It means that red blood cells from the alligator will be examined with a microscope and the nuclei will be counted.

B. It means that red blood cells from the alligator will be examined using restriction enzymes to count the number of centromeres that are present on the chromosomes.

C. It means that chromosomes from the red blood cells of the alligator will be examined with a microscope, photographed, counted, lined up with their respective homologous partner, and displayed.

D. It means that chromosomes from the red blood cells of the alligator will be examined with a microscope to determine the amount of hemoglobin present.

10. In humans the diploid number of chromosomes is 46. The haploid number is 23. Prior to mitosis in the cell cycle, the cell is in the G2 phase. Which of the statements is true?

A. The homologous chromosomes are lined up on the equator.

B. The homologous chromosomes have all been copied through DNA replication and are now sister chromatids.

C. The homologous chromosomes have been pulled to their respective poles by the spindle apparatus.

D. The homologous chromosomes have not been replicated yet.

11. Occasionally, chromosomes fail to separate during meiosis, leading to a condition in which the diploid number is not normal. This phenomenon is called

A. epistasis.

B. nondisjunction.

C. disjunction.

D. pleiotropy.

12. A scientist was collecting data about the number of chromosomes that a certain organism had. Most of the skin cells that he examined had a certain amount of chromosomal material, but he found some skin cells with double the chromosomal material. What might be the explanation for these findings?

A. His samples were contaminated.

B. Some skin cells were in the G2 phase.

C. The cell cycle for the organism was in the G1 phase.

D. Some skin cells had mutated and formed cancer cells.

13. Which of the following is NOT a correct statement about the events of the cell cycle?

A. Interphase is usually the longest phase.

B. DNA replicates during the S phase.

C. Cell division ends with cytokinesis.

D. The cell grows during the G_2 phase.

14. Cells grown in a petri dish tend to divide until they form a thin layer covering the bottom of the dish. If cells are removed from the middle of the dish, the cells bordering the open space will begin dividing until they have filled the empty space. What does this experiment show?

A. Cells come into contact with other cells, they stop growing.

B. The controls on cell growth and division can be turned on and off.

C. Cell division can be regulated by factors outside the cell.

D. All of the above

15. What happens when cells come into contact with other cells?

A. They divide more quickly.

B. They produce cyclins.

C. They stop growing.

D. They produce p53.

16. Binary fission in prokaryotes concludes with the accumulation of _____ protein at the midpoint of the cell which facilitates septum formation.

17. Normally _____ functions in the cell to stop cell division if the cell has experienced extensive DNA damage.

18. If a normal cell is touched on all sides by other cells and is injected with cyclin from a dividing cell, it will probably _____.

19. Proteins that regulate the cell cycle based on events inside the cell are called _____regulators.

20. The _____ checkpoint ensures that the genetic material is distributed equally between daughter cells.

SECTON B: Answer All Questions (30 Marks)

1. a. Explain how cancer might be associated with improper regulation of the cell cycle? **(1 Mark)**

b. Compare plant cells and animal cells in terms of cytokenesis **(2 Marks)**

c. Chemical substance X was applied to a cell culture but did not cause the cells to become cancerous. Chemical substance Y was also applied to the same cell culture (with substance X absent) but did not cause the cells to become cancerous. When both substances X and Y were applied to the cell culture the cells became cancerous. What can you deduce about substances X and Y as to whether they are carcinogenic, and as to their category of carcinogen, if any? **(2 Marks)**

2. a. Before a cell can divide, it must double its materials, machinery, and memory. Explain **(1 Mark)**

b. Briefly describe the effects of DNA damage on the cell cycle. **(2 Marks)**

c. Colchicine is a poison that binds to tubulin and prevents its assembly into microtubules; cytochalasins are compounds that bind to the ends of actin filaments and prevent their elongation. What effects do you think that these two substances would have on cell division in animal cells? **(2 Marks)**

3. Why is it important for chromosomes to be condensed during mitosis and decondensed during interphase? **(5 Marks)**

4. Briefly explain five cell-specific factors that influence the onset of cell division **(5 Marks)**

5. a. Most of the trees that grow on top of the mountain are tall and most of the trees that grow in the valley are short. Based on your knowledge of evolution, how would you explain this phenomenon? **(4 Marks)**

b. The sputum of many smokers contain cells with mutations in the genes for p53. The smoking induced mutations appear to be an early signal showing that cancer of the lungs will follow. What is the likely relationship between early p53 mutation and the development of lung cancer? **(1 Mark)**

6. a. Briefly describe in general the activities of cyclin-dependent kinases (CDKs) **(1 Mark)**

b. How are CDKs regulated? **(4 Marks)**

SECTON C: Answer any Two Questions (20 Marks)

1. Discuss two functional parameters for cell size that limit growth or influence the start of a new cell division **(10 Marks)**

2. Although the general logic of cell-cycle regulation now seems well established, many critical details remain to be discovered. Substantiate this point of view **(10 Marks)**

3. The process of searching for new cancer drugs has undergone a major change. It has moved from a strategy identifying drugs that kill tumour cells towards a more mechanistic strategy acting on molecular targets that underly cell transformation. In light of this argument, discuss the future prospects of anticancer drug development **(10 Marks)**