Full Name:	Civics group: 21S	Index no.:	Date:

Core Idea 2: Genetics and Inheritance

Molecular Biology of Cancer

Tutorial 11

Question	1	2	3	4	5	6	7	8	9	10
Answer										

1 Which of the following contribute(s) towards cancer progression?

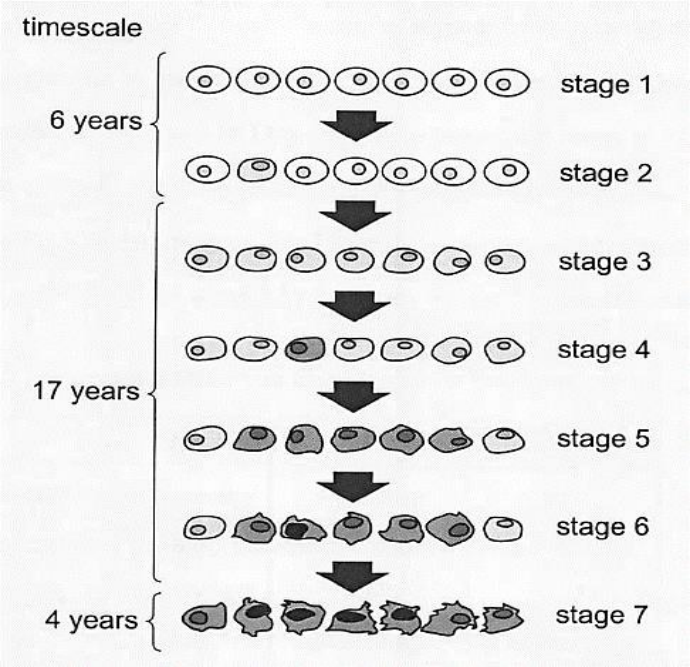
1 Activation of genes that causes cell death.
2 Inactivation of genes that slow down the cell cycle.
3 Activation of genes that result in growth of new blood vessels.
4 Inactivation of genes involved in cell-cell adhesion.

A 2 only
B 1 and 3
C 1 and 4
D 2,3 and 4

2 Which of the following is **not** true about cancer cells?

A Metastasis establishes new tumours distant from the site of the primary tumour.
B Telomerase maintains the length of telomeres, allowing for continuous cell division.
C Angiogenesis forms new blood vessels and brings nutrients and oxygen to the tumour.
D Cancer cells exhibit anchorage dependence.

3 [9648/2013/1/19] The diagram represents stages in the development of a particular cancer in an adult person, over a period of 27 years.



Which shows the processes happening between each of the stages indicated?

	stage 1 to stage 2	stage 3 to stage 4	stage 4 to stage 5	stage 5 to stage 6
A	mutation	proliferation	mutation and proliferation	mutation and proliferation
B	mutation	mutation and proliferation	proliferation	mutation and proliferation
C	mutation and proliferation	mutation and proliferation	proliferation	mutation
D	mutation	mutation	proliferation	mutation

4 It has been suggested that It has been suggested that breast cancer cells produce high levels of hydrogen peroxide. This causes connective tissue cells near the cancer cells to digest some of their mitochondria, releasing nutrients which feed the cancer cells.

Which observations made on breast cancer cells and connective tissue cells growing in tissue culture support this view?

1. Breast cancer cells grown alone produce hydrogen peroxide.
2. Treating breast cancer cells with hydrogen peroxide causes apoptosis.
3. Connective tissue cells grown with breast cancer cells have reduced mitochondrial activity.
4. Treating breast cancer cells with peroxidase increases cancer cell death.

A 1, 2, 3 and 4
B 1, 3 and 4 only
C 1 and 4 only
D 2 and 3 only

5 Mammalian cells growing in tissue culture divide for several generations and form thin layers on solid surfaces. Growth is inhibited by cell-cell contact (contact inhibition).

After the majority of cells have died, cancerous cells may remain as a result of changes that occurred in three stages.

Immortalization → transformation → metastasis

Descriptions of the cells in each of these stages are listed.

1. Cells can divide indefinitely and become mobile, migrating to form new colonies.
2. Cells can divide indefinitely and show contact inhibition.
3. Cells can divide indefinitely and do not show contact inhibition.

Which row correctly describes the cells at each of these three stages?

	Immortalisation	Transformation	Metastasis
A	1	2	3
B	2	1	3
C	2	3	1
D	3	2	1

In-Class Activity

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Development of cancer is a multi-step process. Occasionally, a single mutation is sufficient to transform a normal cell into a malignant cell.

Some mutations may cause activation of telomere gene. Telomerase enzyme prevents end replication problem from occurring, hence preventing the shortening of the chromosome ends. As such, the cell can continue to divide indefinitely.

Some mutations cause cells to lose the ability to differentiate.

Some mutations cause cells to no longer exhibit anchorage dependence where the cancer cells can divide well beyond a single layer and pile up in chaotic fashion.

Some mutations cause a loss of density-dependent inhibition where the cancer cells are capable of cell division in suspension as they have developed the ability to break down substances around it to create more space to grow and divide.

The accumulation of mutations may result in the formation of malignant tumours.

Mutations can also lead to metastasis, where there is a formation of new network of blood vessels to the cancer cells. The blood vessels provide the cancer cells oxygen and nutrients for growth and to remove any waste products.

Some mutations allow for angiogenesis to occur where cancer cells are able to break loose and travel in the bloodstream and invade other tissues to form secondary tumours. At this point, the tumour is considered benign.

STRUCTURED QUESTIONS

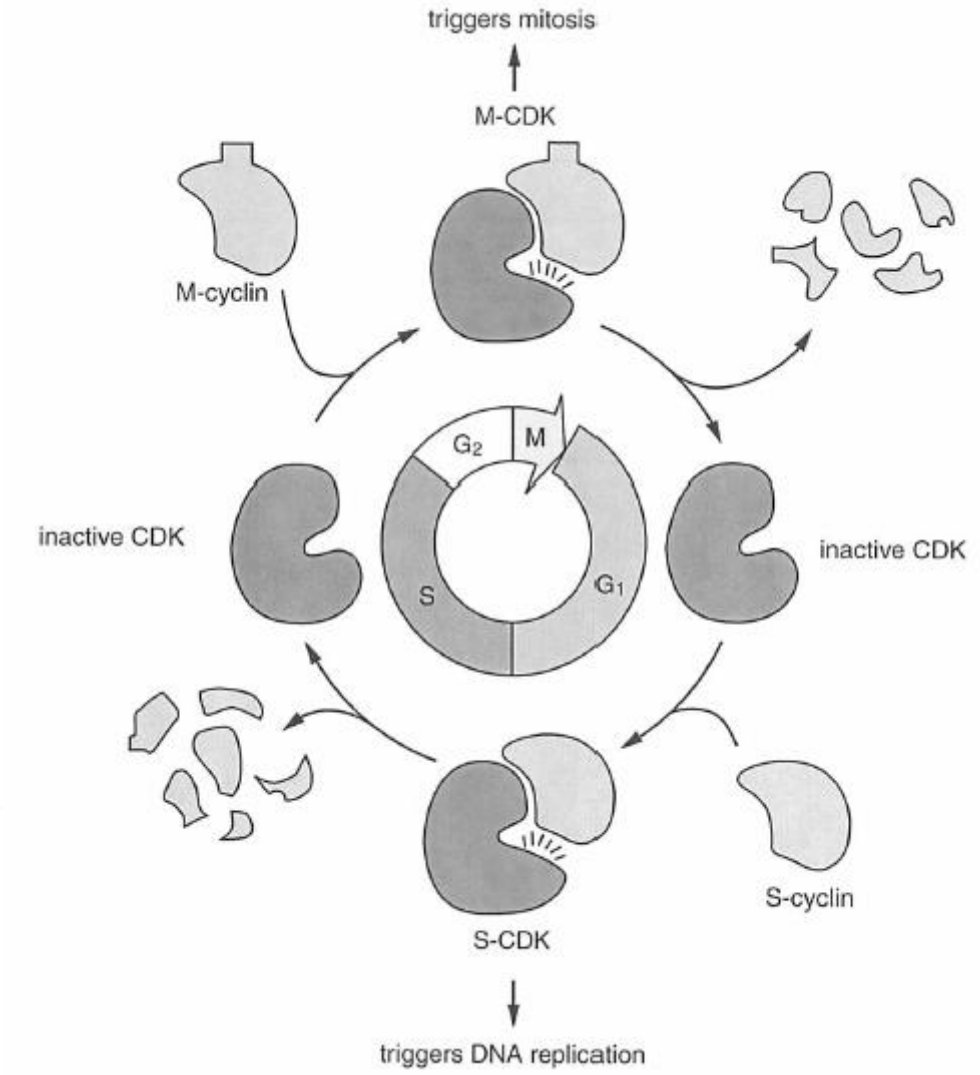
QUESTION 1 (9648 / 2013 / 2 / Q2)
In normal cells, the cell cycle is controlled at checkpoints.

In cancer, in addition to altered growth-controlling genes, many types of cancerous cells have inactivated checkpoint controls.

These checkpoints involve proteins called Cyclin-Dependent-Kinases (CDKs).

CDK proteins are inactive but are activated by binding to cyclins, which are broken down after use. CDK levels are constant whereas cyclins undergo synthesis and degradation in each cell cycle.

Fig. 2.1 shows the main stages in the cell cycle and two of these checkpoints.



(a) State what happens if a cell loses control of the cell cycle.

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(b) With reference to Fig. 2.1, suggest how the dysregulation of checkpoints of cell division may occur.

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(c) **(i)** Name **one** causative agent of cancer.

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(d) **(ii)** Outline the development of cancer including the effects of this causative agent.

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[Total: 10]

QUESTION 2 (9744/2019/P3Q1b)

Curcumin is a yellow pigment found in the spice turmeric, which is used in curry powder. Curcumin also has medicinal properties.

(a) In vitro experiments show that curcumin decreases the proliferation of cancer cells are cultured in laboratory apparatus.

In one experiment, the mitotic cell cycle of cancer cells in culture was synchronized so that they all entered G1 phase at the same time. The cells were then transferred to culture media containing different concentrations of curcumin. Nine hours later, the percentage of cells in each phase of interphase was recorded. None of the cells had completed the G2 phase of interphase.

The results of this experiment are shown in Fig. 1.2.

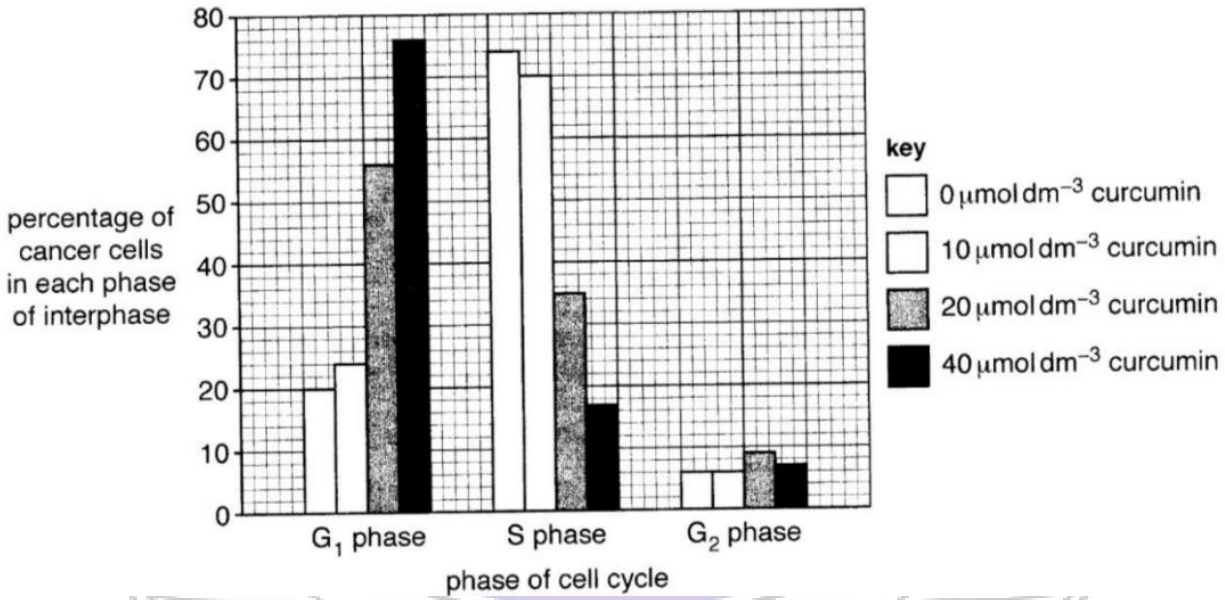

Fig. 2.1

(i) With reference to Fig. 1 .2, describe the effect of curcumin on the percentage of cancer cells in each phase of interphase nine hours after entering G1 phase.

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(ii) With reference to Fig. 1.2, suggest how curcumin affects the mitotic cell cycle and how this could help in the treatment of cancer.

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…… [4]

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Core Idea 2: Genetics and Inheritance

Cancer

Marked Assignment – Peer marking

Describe the development of cancer as a multi-step process. [8]