

# CHAPTER 18

## THE CELL DIVISION CYCLE

© 2009 Garland Science Publishing

### Overview of the Cell Cycle

- 18-1** For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; use each word or phrase only once.

The four phases of the cell cycle, in order, are G<sub>1</sub>, \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_. A cell contains the most DNA after \_\_\_\_\_ phase of the cell cycle. A cell is smallest in size after \_\_\_\_\_ phase of the cell cycle. Growth occurs in \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ phases of the cell cycle. A cell does not enter mitosis until it has completed \_\_\_\_\_ synthesis.

|                |            |         |
|----------------|------------|---------|
| DNA            | M          | protein |
| G <sub>1</sub> | nucleotide | S       |
| G <sub>2</sub> | organelle  |         |

- 18-2** What would be the most obvious outcome of repeated cell cycles consisting of S phase and M phase only?
- (a) Cells would not be able to replicate their DNA.
  - (b) The mitotic spindle could not assemble.
  - (c) Cells would get larger and larger.
  - (d) The cells produced would get smaller and smaller.
- 18-3** A mutant yeast strain stops proliferating when shifted from 25°C to 37°C. When these cells are analyzed at the two different temperatures, using a machine that sorts cells according to the amount of DNA they contain, the graphs in Figure Q18-3 are obtained.

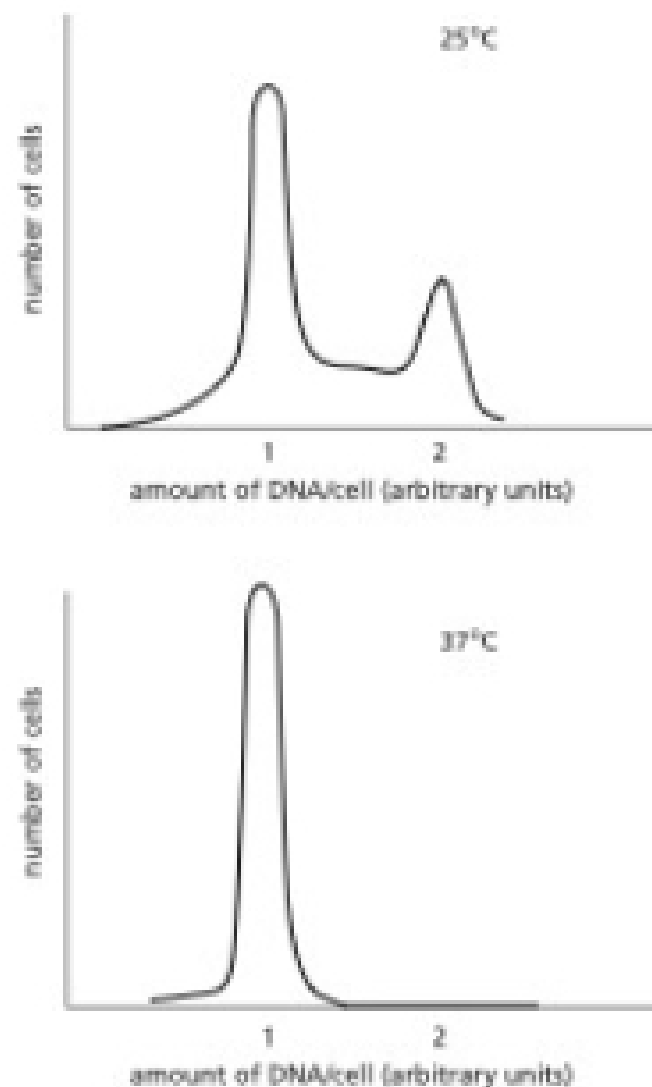


Figure Q18-3

Which of the following would *not* explain the results with the mutant?

- (a) inability to initiate DNA replication
- (b) inability to begin M phase
- (c) inability to activate proteins needed to enter S phase
- (d) inappropriate production of a signal that causes the cells to remain in G<sub>1</sub>

**18-4** Which of the following events does *not* usually occur during interphase?

- (a) Cells grow in size.
- (b) The nuclear envelope breaks down.
- (c) DNA is replicated.
- (d) The centrosomes are duplicated.

- 18-5** What would happen to the progeny of a cell that proceeded to mitosis and cell division after entering S phase but had not completed S phase? Keep in mind that highly condensed chromatin, including the centromere region, is replicated late in S phase. Explain your answer.
- 18-6** Are the statements below *true* or *false*? Explain your answer.
- A. **Statement 1:** Generally, in a given organism, the S, G<sub>2</sub>, and M phases of the cell cycle take a defined and stereotyped amount of time in most cells.
- B. **Statement 2:** Therefore, the cell-cycle control system operates primarily by a timing mechanism, in which the entry into one phase starts a timer set for sufficient time to complete the required tasks. After a given amount of time has elapsed, a molecular “alarm” triggers movement to the next phase.
- 18-7** Which of the following statements about the cell cycle is *false*?
- (a) Once a cell decides to enter the cell cycle, the time from start to finish is the same in all eucaryotic cells.
- (b) An unfavorable environment can cause cells to arrest in G<sub>1</sub>.
- (c) A cell has more DNA during G<sub>2</sub> than it did in G<sub>1</sub>.
- (d) The cleavage divisions that occur in an early embryo have short G<sub>1</sub> and G<sub>2</sub> phases.
- 18-8** Which of the following descriptions is consistent with the behavior of a cell that lacks a protein required for a checkpoint mechanism that operates in G<sub>2</sub>?
- (a) The cell would be unable to enter M phase.
- (b) The cell would be unable to enter G<sub>2</sub>.
- (c) The cell would enter M phase under conditions when normal cells would not.
- (d) The cell would pass through M phase more slowly than normal cells.

### How We Know: Discovery of Cyclins and Cdks

- 18-9** For each of the following sentences, fill in the blanks with the best word or phrase selected from the list below. Not all words or phrases will be used; each word or phrase should be used only once.

Many features of \_\_\_\_\_ cells make them suitable for biochemical studies of the cell-cycle control system. For example, the cells are unusually large and are arrested in a