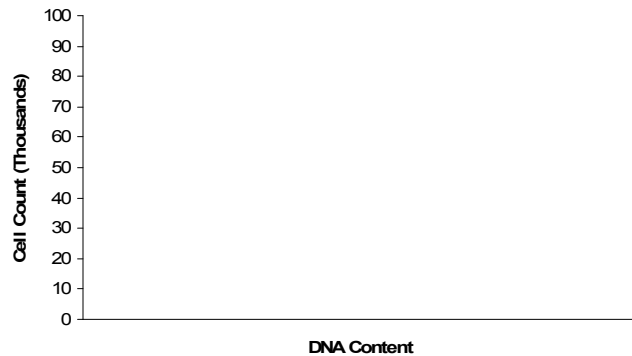
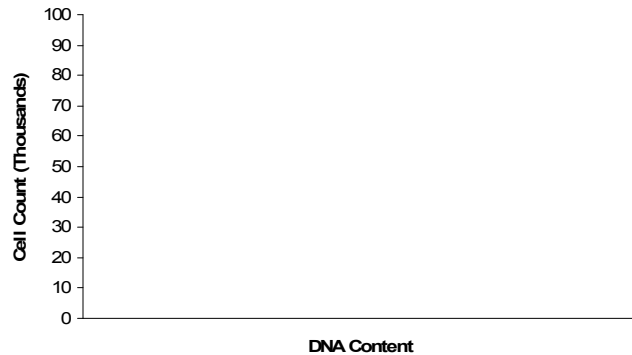


1. Distinguish M phase from interphase.
2. During which phase of the cell cycle does DNA replication occur? For a cell that has $2N=4$, draw the chromosomes at the beginning, middle, and end of this phase.
3. How does an oncogene differ from a protooncogene?
4. Explain the purpose of the metaphase checkpoint.
5. A diploid cell ($n = 23$) progresses through the cell cycle. How many double-stranded molecules of DNA are present in G_1 immediately following M phase? Explain your reasoning.
6. You are investigating the role of your favorite cyclin in regulating the cell cycle. You observe that the amount of the cyclin oscillates, peaking during M phase. You apply a drug that causes the amount of the cyclin to no longer oscillate; instead it remains at peak levels throughout the cell cycle. Would this be a problem? Explain your answer.

7. The technique of flow cytometry allows individual cells in a population to be examined for differences in staining. The data are typically graphed with staining intensity on the x-axis and cell count on the y-axis. For the following questions, different populations of cells are stained with a DNA-binding dye and examined using flow cytometry.

A) Sketch what you would expect for a population of normal cells capable of division. These cells have not been synchronized with regard to the phases of the cell cycle. Hint: consider the amount of DNA present during each phase of the cell cycle. Label DNA content of $1n$ and $2n$ on the x-axis.

B) Sketch what you would expect for a population of cells arrested at the G_1 checkpoint. Label DNA content of $1n$ and $2n$ on the x-axis.



8. Compare and contrast G_0 , G_1 , and G_2 .
9. Draw the cell cycle for a cell for which $N=2$, indicating the changes in the chromosomes and overall DNA content throughout the cycle.
10. Many questions on my exams come from workshop problems. Although they may appear different on the exam, the same concepts and skills are presented in a similar manner to these questions. After workshop, how many people in your group go through these questions prior to the exam?

ACROSS

- 6. Part of the cell cycle that includes mitosis and cytokinesis.
- 8. Part of the cell cycle that includes G1 phase, S phase, and G2 phase.
- 9. The concentrations of these proteins oscillate during the cell cycle.
- 11. Tumor suppressor that plays an important role in responding to DNA damage at the G1 checkpoint.
- 13. Process by which a nucleus is divided.
- 15. Part of the cell cycle that follows M phase and occurs before S phase.

DOWN

- 1. This enzyme requires a cyclin for activation.
- 2. A gene that functions to inhibit cell cycle progression.
- 3. Part of the cell cycle that follows DNA synthesis.
- 4. A cell that has exited the cell cycle is said to be in this.
- 5. A point in the cell cycle at which progression through the cell cycle is specifically regulated.
- 7. A gene that normally functions to encourage cell cycle progression can be mutated to form this, which plays a role in the development of cancer.
- 10. Includes interphase and M phase.
- 12. A cell cannot pass this checkpoint if its chromosomes are not properly attached to the spindle.
- 14. Part of the cell cycle during which DNA replication occurs.

