

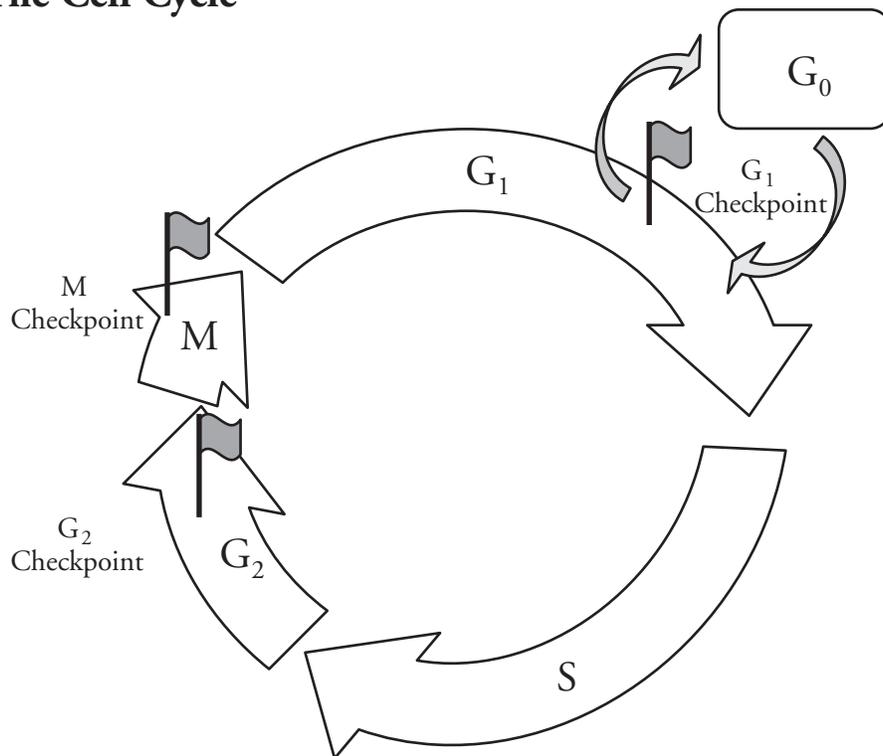
Cell Cycle Regulation

How does a cell know it is time to divide?

Why?

Quality control inspectors typically do not limit their product testing to the final product at the end of the assembly line. They monitor all aspects of production in hopes of preventing larger problems down the line. Likewise, when cells are progressing through the cell cycle there are processes in place that check on the cell's progress. Is everything happening according to plan? Are there sufficient resources to complete the task of cell division? Tightly regulating the cell cycle keeps a multicellular organism healthy by conserving materials. This ensures that new cells receive accurate genetic information, and also prevents uncontrolled growth that may lead to diseases like cancer.

Model 1 – The Cell Cycle



1. Review the phases of the cell cycle in Model 1 by placing the abbreviated phase name (G_1 , S , G_2 or M) next to the proper description.
_____ The cell grows by producing more proteins and organelles.
_____ DNA replication occurs.
_____ The cell prepares for cell division with the appearance of centrosomes.
_____ Mitosis and cytokinesis occurs.
2. Some cells, like mature nerve cells or muscle cells, do not divide. Other cells will divide only when the cellular environment signals that it is necessary. According to Model 1, what “phase” of the cell cycle are these cells said to be in when they are not dividing or planning to divide?

3. There are three regulatory checkpoints built into the cell cycle.
- Name the three checkpoints as shown on Model 1.
 - Indicate the phase of the cell cycle, and what part of the phase (early or later), where each checkpoint occurs.



4. Progression through the cell cycle is dependent on both extra- and intracellular conditions. Consider the following conditions. Indicate which checkpoint(s) most likely responds to that condition.
- The DNA has been completely replicated and checked for errors.
 - There is ample supply of energy and raw materials available.
 - All chromosomes are attached to the spindles.
 - There is adequate room in the environment for more cells.
5. Which checkpoint appears to regulate whether the cell is in G_0 or not?
6. Predict the result of a mutation that allows a cell to move past checkpoint G_1 even though the cell has not grown sufficiently.
7. Predict the result of a mutation that allows a cell to move past checkpoint G_2 even though DNA replication has not been completed.
8. Predict the result of a mutation that allows a cell to move past checkpoint M even though the chromosomes were not prepared for division.

