

Using an Inhibitor to Arrest the Cell Cycle

Many medical treatments are aimed at stopping cancer cell proliferation by blocking the cell cycle of cancerous tumor cells. One potential treatment is a cell cycle inhibitor derived from human umbilical cord stem cells.

1. [SP 3] Propose a hypothesis researchers might have used for this investigation.

In the treated sample, human glioblastoma (brain cancer) cells were grown in tissue culture in the presence of the inhibitor, while a control sample of glioblastoma cells was grown in its absence. After 72 hours of growth, the two cell samples were harvested. To identify the phase of the cell cycle each cell was in at that time, the samples were treated with a fluorescent chemical that binds to DNA and then run through a flow cytometer, an instrument that records the fluorescence level of each cell. Computer software then graphed the number of cells in each sample with a particular fluorescence level, as shown in Figure 1.

2. [SP 3] Identify the independent and dependent variables.

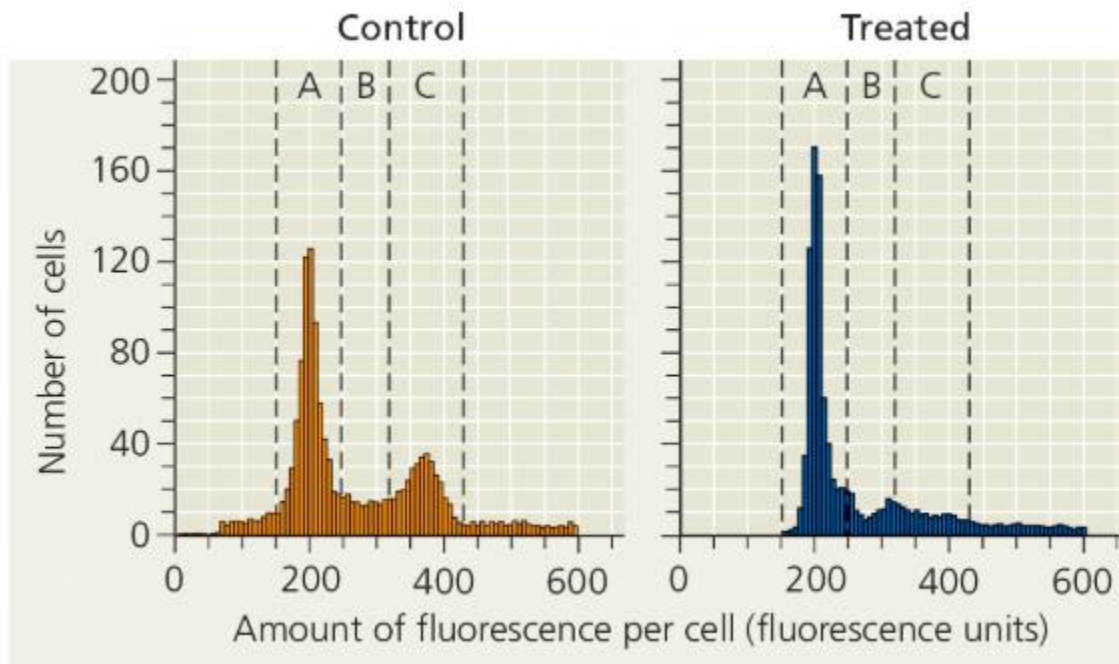


Figure 1 Fluorescence in cells after 72 hours of growth

Each narrow bar in the histogram represents the number of cells observed to have a level of fluorescence in the range of that interval. This in turn indicates the relative amount of DNA in those cells. Overall, comparing the two histograms allows you to see how the DNA content of this cell population is altered by the treatment.

3. [SP 4, SP 6] a) Identify the axis which indirectly shows the relative amount of DNA per cell. Justify your response.
b) [SP 6] Propose a reason the researchers were able to use the amount of DNA in the cell to identify the phase of the cell cycle the cell was in.

4. a) [SP 4] In the control sample, compare the first peak in the histogram (in region A) to the second peak (in region C). Identify the peak that shows the population of cells with the higher amount of DNA per cell. Justify your choice.
b) [SP 4, SP 6] Propose a reason why the peak in C is shorter than the peak in A.
5. [SP 4, SP 6] In the control sample histogram, identify the phase of the cell cycle (G_1 , S, or G_2) of the population of cells in each region (A, B, and C). Justify your response.
6. [SP 6] Based on the data, make a claim about the potential efficacy of the inhibitor as a cancer treatment.
7. [SP 6] Propose a mechanism by which the stem cell-derived inhibitor might arrest the cancer cell cycle at this stage.