

## DNA Content Change During Yeast Cell Meiosis

When nutrients are low, cells of the budding yeast (*Saccharomyces cerevisiae*) exit the mitotic cell cycle and enter meiosis. In this exercise, you will track the DNA content of a population of yeast cells as they progress through meiosis.

Researchers grew a culture of yeast cells in a nutrient-rich medium and then transferred the cells to a nutrient-poor medium to induce meiosis. At different times after induction, the DNA content per cell was measured in a sample of the cells, and the average DNA content per cell was recorded in femtograms (fg;  $1 \text{ femtogram} = 1 \times 10^{-15} \text{ gram}$ ).

Table 1 Amount of DNA in yeast cells over time

Time after Induction (hours)	Average Amount of DNA per Cell (fg)
0.0	24.0
1.0	24.0
2.0	40.0
3.0	47.0
4.0	47.5
5.0	48.0
6.0	48.0
7.0	47.5
7.5	25.0
8.0	24.0
9.0	23.5
9.5	14.0
10.0	13.0
11.0	12.5
12.0	12.0
13.0	12.5
14.0	12.0

1. [SP 1] Propose a reason why yeast cells exit the mitotic cycle when nutrients are low.
2. [SP 4] Graph the data.
3. [SP 1, SP 6] The curve is not flat for each stage of meiosis and the amount of DNA does not drop instantly at the end of MI or MII. Explain these observations.
4. [SP 4, SP 6] Most of the yeast cells in the culture were in G<sub>1</sub> of the cell cycle before being moved to the nutrient-poor medium. State the number of femtograms of DNA present in each yeast cell in G<sub>1</sub>, at the end of meiosis I, at the end of meiosis II, and in G<sub>2</sub>.
5. [SP 6] Using these values as a guideline, distinguish the different phases by inserting vertical dashed lines in the graph between phases and label each phase (G<sub>1</sub>, S, G<sub>2</sub>, MI, MII). You can figure out where to put the dividing lines based on what you know about the DNA content of each phase.

6. a) [SP 4, SP 6] Think carefully about the point where the line at the highest value begins to slope downward. Identify the specific point of meiosis that this “corner” represents.
- b) [SP 1, SP 6] Propose an explanation for the fact that the line is not vertical.
- c) [SP 1, SP 6] Explain why the line does not increase again after the 8 hour mark.