ChromoSock Mitosis

Student Protocol

Overview

In order for organisms to grow, their cells must also grow and multiply. In this activity, students will simulate the movement of chromosomes during cell division. Students will use ChromoSocks to model the behavior of chromosomes during mitosis. Throughout the activity, pay attention to the chromosome number and the ploidy as the chromosomes are moved through each stage in the dividing cell.

Learning Objectives

Define haploid and diploid
Identify chromosome number at several points during mitosis
Identify mitosis as the division that produces identical 'daughter cells'
Model mitosis
Correctly label centromere, chromosome (both replicated and non-replicated) and chromatids in a diagram

Materials

2 Bags of ChromoSocks for each pair of students. Each bag contains:
1 white ChromoSock with an orange stripe labeled "F"
1 white ChromoSock with an orange stripe labeled "f"
1 beige ChromoSock with a green stripe labeled "B"
1 beige ChromoSock with a green stripe labeled "b"
1 grey ChromoSock with a black stripe labeled "N"
1 grey ChromoSock with a black stripe labeled "n"
Rubber bands

Preparing for Mitosis

1. Working with a partner(s)/, open one bag of ChromoSocks. The socks inside represent the chromosomes that have been passed from parent to offspring.

2. Remove the ChromoSocks and arrange in pairs on your desk. Chromosomes, like socks, occur in pairs. These pairs are called homologs, or homologous chromosomes.
Draw the cell and label the chromosome ploidy and number. Use an "I" shape to represent each single chromosome.

3. Before any cell can enter mitosis, the DNA must be replicated. Replication is the process of using a double sranded DNA molecule as the template for building two copies of the DNA. Open the second bag of ChromoSocks.

4.Use the second bag of ChromoSocks to replicate the ChromoSocks from the first bag. Match each ChromoSock in the second bag to an identical ChromoSock from the first bag. Use rubber bands to connect the replicated ChromoSocks. The rubber band represents the centromere, or region where sister chromatids attach in a replicated chromosome. Make sure to match capital and lowercase lettered socks appropriately.

5.Sketch the cell following DNA replication. Label the chromosome ploidy and number. Use an ")(" shape to indicate each replicated chromosome in the sketches.

6. Choose a replicated chromosome in your sketch and label the following: *centromere, chromosome and chromatid*.

Mitosis

7. The following steps provide direction for using the ChromoSocks to model each phase of mitosis.

8. At the beginning of mitosis, there is one pile of ChromoSocks representing the chromosomes in the nucleus of a single cell. Line up the replicated ChromoSocks in a vertical line to represent how chromosomes line up along the equator of the cell. Sketch the chromosomes in the cells.

9. Remove the rubber bands, simulating the physical change in the centromere that allows chromatids to separate. At this point, the replicated chromosome no longer behaves as a single unit. Separate the sister chromatids by moving one of each ChromoSock to opposite sides of the 'cell'. Sketch the chromosomes at the end of this process.

10. Collect the ChromoSocks into two separate tight bundles simulating the reforming of the nuclear membrane. The remaining contents of each cell will separate in a process known as cytokinesis resulting in a total of 2 cells.

11. Carefully count the number of ChromoSocks in each new cell. Sketch the chromosomes in each cell and label the chromosome ploidy and number beside each sketch.
How does the chromosome number compare to the original cell? How do the types of chromosomes present compare to the original call?

12. Replace the ChromoSocks in the bags. Each bag should contain 2 long white, 2 medium grey and 2 short beige ChromoSocks with one capital and one lowercase of each letter. In other words, each bag is heterozygous for each trait.