

CELL CYCLE AND MITOSIS VS. MEIOSIS SIMULATION

In this activity, you will construct chromosomes from plasticine (red/ blue / green) and follow them through the cell cycle followed by mitosis or meiosis. You will make sketches of the chromosomes, with genes (alleles) indicated, on the summary sheet and you will also demonstrate the processes of mitosis and meiosis to your teacher. To assist you during this activity, you can reference p.154 & 155

PART A: THE CELL CYCLE

G1:

Obtain an amount of two different colours of plasticine. Using half of the material supplied, construct one long and one short single stranded (ss) chromosome of each colour. Save the other halves of the plasticine for later. Use a sharp pencil to engrave letters on each chromosome to indicate genes. The 'genome' that you are creating has 2 sets of 8 genes, one set originally inherited from each parent. Each gene has two forms (alleles) represented by a capital or lower-case letter. For example, 'B' might represent brown eye colour while 'b' might represent blue eye colour. Prepare and label the chromosomes as shown below:

Red	Blue	Red	Blue	(** or Green)
A	a	F	f	
B	b	G	g	
D	d	H	h	
E	e	R	r	

You now have constructed two pairs of homologous ss chromosomes. This is how they would appear in the nucleus of a cell in G1.

Synthesis:

Now, using the saved portions of plasticine, replicate each chromosome to make 4 double stranded (ds) chromosomes, each with two identical sister chromatids.

A A
B B etc. for the three other chromosomes
D D
E E

PART B: MITOSIS

After a period in G₂, during which centrosomes would be duplicated, the cell would be ready for mitosis. Using your 4 ds chromosomes, perform the stages of mitosis to produce two identical daughter cells. Do this on the whiteboards using markers to draw centrosomes and spindle fibres. When you are comfortable with the process, call your teacher to demonstrate the stages of mitosis. Do not proceed to the meiosis activity until you have demonstrated mitosis. Now complete your observation sheet for the Cell Cycle and Mitosis.

PART C: MEIOSIS

Reconstruct your 4 ds chromosomes. Now imagine that this is not a regular body cell about to undergo mitosis, but a sex cell (sperm or egg) about to undergo meiosis to make gametes.

Prophase I:

Arrange the chromosomes as two homologous pairs, one long and one short.

With the longer pair, perform a cross-over so that **one 'd-e'** portion is exchanged with **one 'D-E'** portion between non-sister chromatids. (actually exchange pieces of plasticine so that two of your chromatids will now comprise two colours each.)

Metaphase I:

Line up the homologous pairs as they would in metaphase I. Remember that assortment here is independent.

Anaphase I and Telophase I

Separate the homologous pairs to produce 2 cells which are now haploid, each containing 2 ds chromosomes.

Meiosis II:

Now proceed through meiosis II. Remember that it is very similar to mitosis. You should end up with 4 unique haploid cells, each containing 2 ss chromosomes. Check to see that there is one, and only one, copy of each allele in each cell.

Call your teacher to demonstrate the process.

Observation Sheet
Cell Cycle and Mitosis

Name: _____

Make a simple sketch of the chromosomes, labelled with alleles, for each of the indicated stages.

G1

End of Synthesis

Prophase

Metaphase

Anaphase

2 Daughter Cells

Answer the following questions:

1. Mitosis produces 2 daughter cells that are genetically _____.
2. They are haploid/diploid. (circle one)

3. These cells can be used for _____, _____ or _____
Meiosis:

Start of Prophase I

End of Prophase I

Metaphase I

Anaphase I

End of Meiosis I

Prophase II

Metaphase II

Anaphase II

Telophase II & Cytokinesis

End of Meiosis

Answer these questions:

1. Meiosis produces cells that are genetically _____
2. These cells are haploid/diploid. (circle one)
3. These cells will be used to form _____