

LAB #11
MITOSIS & MEIOSIS

OBJECTIVES

- Understand and be able to identify the stages of Mitosis and Meiosis.
- Understand the difference between Mitosis and Meiosis.
- Identify the different stages of Mitosis during microscopic examination of prepared Whitefish blastula slides.
- Define the following terms: Mitosis, meiosis I, meiosis II, prophase, metaphase, anaphase, telophase, interphase, diploid, haploid, parent cell, daughter cell, crossing over, tetrad.

MATERIALS

- Textbook, lecture notes
- 2 colors of Playdoh
- String
- Colored pencils
- Microscope
- Lens paper
- Prepared slide of whitefish blastula

NOTES TO STUDENTS

- This lab is intended to be done *after* your instructor has lectured on mitosis and meiosis. Use your lecture notes and textbook to help complete this lab.

MODELING MITOSIS WITH PLAYDOH

INTRODUCTION

Both mitosis and meiosis deal with nuclear processes that occur during cell division. **Mitosis**, also referred to as somatic cell division, takes place in tissues that are not responsible for the production of gametes (sperm or ova). **Meiosis** takes place in the testes and ovaries and results in the production of gametes.

Organisms that reproduce through sexual reproduction get half of their chromosomes from the father's gamete (sperm) and half of their chromosomes from the mother's gamete (ova). Normal humans have 46 chromosomes, 23 chromosomes inherited from the father and 23 chromosomes inherited from the mother.

Cells that have the full complement of chromosomes, (i.e. there are 46 chromosomes in a human somatic cell), are called **diploid** or **2n**. Cells which have half the normal number of chromosomes (i.e. there are 23 chromosomes in a human ova or sperm cell) are called **haploid** or **n**.

In mitosis, the **parent cell** divides to form two *identical* diploid **daughter cells**. Each daughter cell will have the same number and type of chromosomes as the parent cell.

EXERCISE 1: MODELING MITOSIS

1. Select two different colors of playdoh. One color will represent the chromosomes of the mother and the other color will represent the chromosome of the father.

Mother's color _____ Father's color _____

2. Use the playdoh to make chromosomes (sister chromatids joined by a centromere) for a diploid cell ($2n$) where **n is 4**

Number of mother's chromosomes constructed = _____

Number of father's chromosomes constructed = _____

3. Use the playdoh to make 2 centrioles.
4. Use the string to represent the plasma membrane. Do not make spindle fibers but imagine that they are present.
5. Use the pieces constructed to illustrate the phases of mitosis.
 - a. prophase, metaphase, anaphase, telophase

Explain the various phases of mitosis to your instructor using the models you built.

6. Sketch the results of each phase in table 11.1.

Do not discard your playdoh chromosomes... you will re-use them in Exercise 2.

Table 11.1 Mitosis

PROPHASE	METAPHASE
ANAPHASE	TELOPHASE

MODELING MEIOSIS WITH PLAYDOH

INTRODUCTION

In **meiosis**, the parent cell undergoes two series of cell division which result in the production of four haploid daughter cells. Each of these daughter cells is *unique* and has half the number of chromosomes as the original parent cell.

EXERCISE 2: MODELING MEIOSIS

1. Select two different colors of playdoh. One color will represent the chromosomes of the mother and the other color will represent the chromosome of the father.

Mother's color _____ Father's color _____

2. Use the playdoh to make chromosomes (sister chromatids joined by a centromere) for a diploid cell ($2n$) where **n is 3**.

Number of mother's chromosomes constructed = _____

Number of father's chromosomes constructed = _____

3. Use the playdoh to make 2 centrioles.
4. Use the string to represent the plasma membrane. Do not make spindle fibers but imagine that they are present.
5. Use the pieces constructed to illustrate the phases of meiosis.
 - a. Meiosis I.
 - i. Prophase I (show tetrads and crossing-over)
 - ii. Metaphase I
 - iii. Anaphase I
 - iv. Telophase I
 - b. Meiosis II
 - i. Prophase II
 - ii. Metaphase II
 - iii. Anaphase II
 - iv. Telophase II
 - c. show all 4 daughter cells.

Explain the various phases of mitosis to your instructor using the models you built.

6. Sketch the results of each phase in Table 11.2

When you are done with the playdoh, separate the colors, form like colors into a ball and return to appropriate container.

Table 11.2 Meiosis

PROPHASE I	METAPHASE I
ANAPHASE I	TELOPHASE I
PROPHASE II	METAPHASE II
ANAPHASE II	DAUGHTER CELLS

MITOSIS IN WHITEFISH BLASTULA

Note: If proper use of the microscope has not yet been covered in lab, exercise 3 will be performed during the microscopy lab.

EXERCISE 3: MITOSIS IN WHITEFISH BLASTULA

1. Take out your microscope and obtain a prepared slide of White fish blastula.
2. Starting on low power focus on one of the blastulas and work your way to high power (400x).
3. Analyze the various cells in different stages of mitosis.
 - Note that not all the cells show a distinct nucleus. This occurs because the slides are prepared by cutting blastulas and their cells into *very thin* sections. Each section is then used on a different slide. Some of the section only contain a portion of the cell and so the cell is “missing” its nucleus because the nucleus was captured in a different slice.
4. Identify the following :
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase
 - Centrioles
 - Asters
 - Spindle fibers

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REVIEW QUESTIONS

Modeling Mitosis with Playdoh:

1. How many chromosomes were initially made:
a) 2 b) 4 c) 8
2. How many chromosomes does each daughter cell have:
a) 2 b) 4 c) 8
3. During metaphase the chromosomes are aligned at the:
 - a. edge of the cell
 - b. the poles of the cell
 - c. the equator of the cell

Modeling Meiosis with Playdoh:

4. How many chromosomes were initially made:
a) 3 b) 6 c) 9
5. How many chromosomes does each daughter cell have:
a) 3 b) 6 c) 9
6. During meiosis I, the chromosomes are aligned:
 - a. single file
 - b. double file
7. During which phase of Meiosis do the *homologous chromosomes* separate from each other?
 - a. Metaphase I
 - b. Anaphase I
 - c. Metaphase II
 - d. Anaphase II
8. During which phase of Meiosis do the *sister chromatids* separate from each other?
 - a. Metaphase I
 - b. Anaphase I
 - c. Metaphase II
 - d. Anaphase II
9. During which phase of Meiosis do tetrads form? _____
10. If diploid cells in an organism have 10 chromosomes, how many chromosomes will the gametes have?