

Mitosis Handout A

- Directions:
1. Read. Please highlight KEY ideas.
 2. Circle vocabulary associated with mitosis
 3. Label all of the vocabulary words in the box next to the diagram on the back side.
 4. Answer these questions in your notebook:
 1. Describe 2 changes in each diagram as the cell progresses through mitosis
 2. How much of the cell's time is spent in interphase? In mitosis?
 3. What is the difference in a cell plate and cell cleavage?

During the cell division phase of the cell cycle, the cell undergoes mitosis and then cytokinesis. Mitosis is the process in which the duplicated chromosomal pairs separate and, in cytokinesis, the cell splits to form two new cells. This plate will explore the process of mitosis.

As you may remember, the DNA in the nucleus of the cell replicated during the S phase of the cell cycle, but is not distinguished as distinct chromosomes during the first phase of mitosis, interphase. The **nucleus (B)** contains the DNA in a diffuse mass called chromatin. The **nucleolus (C)** is seen clearly in the interphase cell, and the **nuclear membrane (D)** encloses the nucleus. Color the **cytoplasm (A)** a light color.

Two submicroscopic bodies (also duplicated prior to mitosis) that participate in mitosis are the centrosomes. Each of the centrosomes contains two cylindrical structures that are arranged at right angles to each other, called **centrioles (E)**, which are involved in the organization of microtubules during cell division.

Prophase is the longest phase of mitosis. It begins when the chromatin of the cell nucleus condenses to form distinct chromosomes. Because DNA replication has taken place during interphase, each chromosome is composed of two identical strands, known as **chromatids (G₁)**. Notice that, in early prophase, the centrioles (E) are surrounded by a series of microtubules that radiate outward; these are called **asters (F)**.

In late prophase, the centrioles (E) have moved to opposite poles of the cell and the asters (F) are still visible. **Spindle fibers (H)** can be seen extending between the centrioles and should be traced with a light color such as yellow. Spindle fibers are composed of microtubules and associated proteins. Notice that the chromatids (G₁) have continued to compact, becoming shorter and thicker. The nuclear membrane begins to break apart and disappear as the cell proceeds through late prophase.

The next phase of mitosis is metaphase. Here the chromatid pairs align themselves along the equator of the cell, at an area called the metaphase, or equatorial plate. The chromatids (G₁) are linked near the middle of the chromosome at a development called the **kinetochore (I)**. There is one kinetochore located on each sister chromatid, and their compositions are unknown. At this stage, the spindle fibers (H) are distinct, and they extend out from the centrioles. The remainder of the cytoplasm (A) should be colored in a light color.

In anaphase, the DNA at the kinetochore (I) has duplicated, and the chromatids have separated. Each chromatid is now a **chromosome (G₂)**. Four chromosomes are seen moving to the bottom of the diagram, and four to the top of the diagram. The chromosomes resemble "V's" because the spindle fibers lead them by their centrioles. An equal number of chromosomes move to the opposite poles of the cell. In a human cell, for example, forty-six chromosomes move to one pole and forty-six chromosomes move to the opposite pole.

As the dividing cell enters telophase, you can see that the chromosomes (G₂) arrive at opposite ends of the cell, where they become thinner and less distinct. The spindle fibers (H) begin to break down in this phase, the nuclear membrane (D) begins to form around the chromosomal material, and the nucleolus (C) reappears.

As telophase comes to an end, the cytoplasm (A) is divided between the two new daughter cells. At the center of the cell in animal cells a **cleavage furrow (J)** begins to form as the membrane pinches in from both sides. The appearance of the cleavage furrow signals the end of telophase and the beginning of cytokinesis. The furrow pushes inward from opposite sides of the cell until two cells are created. These cells are referred to as the daughter cells.