Mitosis stop-still animation guidelines.

Objective:
In this lab, you will study the behavior of chromosomes during mitosis. Mitosis is used by eukaryotic single-celled organisms for reproduction, and by multicellular organisms to produce additional cells for growth and tissue maintenance (i.e., replace dying cells).

Materials:

- materials that mimic cell parts involved in mitosis
- digital camera
- tripod
- Windows Movie Maker or iMovie

Procedure:

- Using the available materials, construct a model of a cell for each stage of the cell cycle.
- Take pictures of the different stages of the cell cycle, including mitosis, as a stop-still animation. You will be doing your editing in the camera, so be sure each picture is in sequence.
- Label each stage when it occurs, and leave a label up throughout the stage:

    - Interphase
    - Prophase
    - Metaphase
    - Anaphase
    - Telophase
    - Cytokinesis

- Start with two single-stranded chromosomes. Make sure you represent the cell membrane and nucleus. Before a cell begins mitosis, each chromatid replicates, or makes an exact copy of itself. (**Note**: In a real cell, the DNA is not visible as chromosomes during Interphase, as it is loosely arranged in the form of chromatin—but for this lab, we will start with somewhat visible chromosomes.)
- Label the centromere, sister chromatids, nuclear membrane, cell membrane, and chromosomes. (Anything that appears new or needs to be stressed in your animation should be labeled.)
- Answer the following questions in your notes under *Interphase*:

    - How does one chromatid compare to its sister chromatid?
    - Can you tell the difference between the original and the replicated strand?
    - What are visual clues that tell you that this cell is in Interphase?
    - If you were looking under a microscope at a cell, what would tell you that it is in Interphase (i.e., what can be seen and what is not seen that would indicate mitosis is not yet occurring)?

- Next, model Prophase. The nuclear membrane is starting to break down and the centrioles have moved to opposite poles. The spindle fibers are forming from the centrioles. Label all the parts. Answer the following question in your notes under *Prophase*.
    - What is the purpose of spindle fibers?
- For Metaphase, line your chromosomes up on the equatorial plane. The spindle fibers should attach to the chromosomes in the correct place. Label the chromosomes, chromatids, and spindle fibers. Answer the following questions under *Metaphase:*
    - At this point, the spindle fibers growing out of the poles resemble a star-shaped structure. What is this called?
    - Where do the spindle fibers attach to the chromosomes?
- For the next stage, Anaphase, separate the double-stranded chromosomes; move them toward opposite poles. Answer the following under *Anaphase:*
    - How many chromosomes do you have now?
- In Telophase, the nuclear membrane reforms around the new sets of chromosomes. The chromosomes begin to unwind and become thin strands again. Answer the following questions under *Telophase*:
    - Why are the chromosomes split and pulled to opposite poles?
    - How does this help with cell division?
    - What happens to the chromosomes at this point?
    - What cellular parts disappear and what parts reappear at this stage of mitosis?
- Cytokinesis begins during Telophase and continues after Telophase. Make sure you show the formation of a cleavage furrow and the split into two new cells.
    - What is the role of the cleavage furrow?
    - How would this process differ for a plant cell?
- You are now ready to make your movie. You will use Windows Movie Maker or iMovie to create the final version. We will go over how to do this in the computer lab. Include movie title, credits, and music. Be sure to choose the setting that shortens each picture to the smallest amount of time. Save to the class folder when you are finished. The final movie should range in length from 30 seconds to 1 minute.

Analysis

Answer the following questions on a separate sheet of paper and attach it behind this sheet:

1. What is the final step of the cell cycle that follows Telophase?

2. What are the two identical “offspring” cells that come from the parent cell?

3. Why is mitosis important? What does mitosis do that the cell would do wrong if it just split down the middle in cell division?

4. How many chromosomes are present in each daughter cell in this lab?

5. Why was it necessary to replicate the chromosomes during the S (synthesis) phase before mitosis began?

6. A common biological study specimen, the fruit fly, has four pairs of chromosomes in each cell. As it grows, it reproduces more cells via mitosis. How many chromosomes would you expect to find in each of the new cells?

7. Number the following steps in the correct order (write the stage in which each occurs):
   - A cleavage furrow or cell plate forms, separating the nuclei.
   - Chromosomes line up at the equator and chromotids are attached to spindle fibers.
   - Nuclear membrane and nucleolus reappear.
   - Genetic material replicates and is joined at the centromere.
   - Centromeres divide and single-stranded chromosomes move to poles.