

Mitosis

Objectives

Having completed the lab on mitosis, you should be able to:

1. Identify each phase of mitosis on the onion root tip and the whitefish blastula.
2. Describe the events during each phase of mitosis.
3. Explain differences in mitosis between plant and animal cells.

Introduction

According to the cell theory of biology, all cells arise from pre-existing cells. In eukaryotes, this generally occurs by the process of mitotic cell division, which involves the separate but often coordinated processes of cytokinesis (division of the cytoplasm and organelles) and mitosis (division of the nucleus and associated DNA). Mitosis without the co-occurrence of cytokinesis leads to the production of multinucleated cells, such as those found naturally in skeletal muscle and cardiac muscle. Mitotic cell division leads to the production of genetically identical daughter cells from existing parent cells. Mitotic cell division is used in asexual reproduction, growth, and repair. Meiosis is another form of cell division in eukaryotes that leads to the production of gametes.

While the process of mitosis is continuous process within the cell cycle (i.e., it doesn't occur in discrete steps), biologists are classifiers and tend to place things into discrete categories. Mitosis is commonly divided into four major phases: prophase, metaphase, anaphase, and telophase. You may find that some accounts of mitosis further subdivide the process to include prometaphase between prophase and metaphase. In this exercise, we will consider prometaphase a component of prophase.

Mitosis Diagram

Using Figures 1 - 4, diagram the phases of mitosis and in the space provided to the right, describe the events of each phase using a chromosome number of 6 ($2n = 6$).



Figure 1: Prophase

Figure 2: Metaphase

Figure 3: Anaphase

Figure 4: Telophase



Mitosis in the Onion Root Tip

Introduction

In plants, cell division generally takes place in meristematic tissues where the plant is actively growing, at the apex of roots and shoots. An onion root may be divided roughly into four regions:

1. the root cap-protective tissue composed largely of dead cells
2. meristematic tissue-rapidly dividing cells located just behind the root cap
3. elongating cells-located immediately behind the meristematic tissue
4. mature and specialized cells-root hairs and other plant tissues

You will be examining cells of the meristematic tissue, located just behind the root cap at the tapered end of the root tip.

Materials

1. Compound microscope
2. Onion root tip slide

Procedure

1. In Figure 5, identify the phase of mitosis and write the name of the phase below each diagram. The cells go in the appropriate temporal sequence through cell cycle and you are likely to use the same term multiple times. While technically not a phase of mitosis, you may use "interphase" for some of the cells, but you should not use "cytokinesis."
2. Hold the slide of the onion root up to the light and note that there are several longitudinal sections on the slide. Examine all sections on the slide. Locate the meristematic tissue to observe phases of mitosis using high power.
3. Find each phase of mitosis on the slide. As you locate each phase, your instructor will verify that you are correct and initial your paper. After you have received verification from your instructor, draw the cell in Table 1.



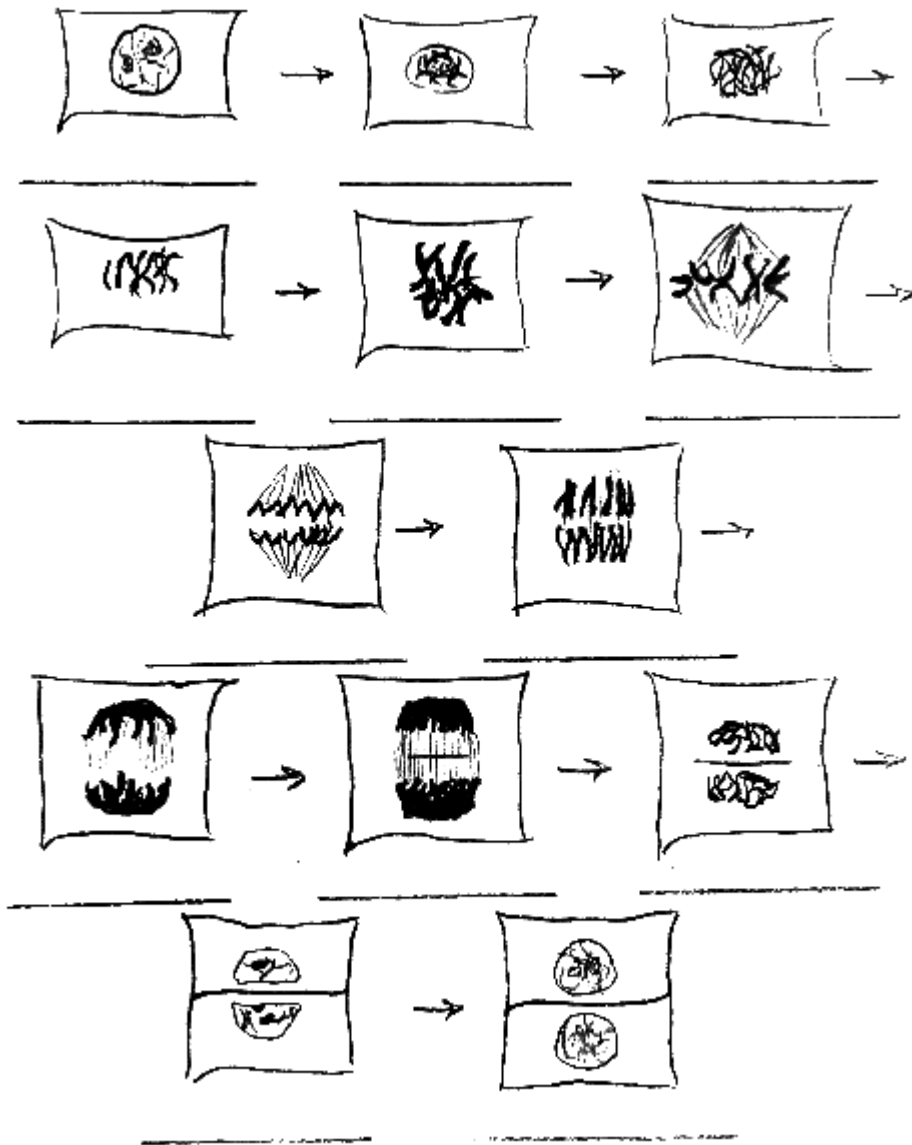


Figure 5: Mitosis in the onion root tip.

Mitosis in the Whitefish Blastula

Introduction

While the onion root cells tend to be arranged in a planar fashion, the whitefish blastula is more spherical. As a result, the whitefish cells are oriented in a less orderly fashion than the regular, patterned. When a section is cut from the blastula, some mitotic figures will be visible and familiar, as in the root tip, but other cells will be cut so that many mitotic figures may have an unfamiliar or atypical appearance. Disregard these and concentrate on those which can be seen in full view. As a result, finding each stage of mitosis may require more searching in the whitefish blastula.



Materials

1. Compound microscope
2. Prepared slide of whitefish blastula

Procedure

1. In Figure 6, identify the phase of mitosis and write the name of the phase below each diagram. The cells go in the appropriate temporal sequence through cell cycle and you are likely to use the same term multiple times. While technically not a phase of mitosis, you may use "interphase" for some of the cells, but you should not use "cytokinesis."
2. Hold the slide of the whitefish blastula to the light and note that there are a number of sections on the slide. Examine all sections on the slide using high power to locate all the phases of mitosis.
3. Find each phase of mitosis on the slide. As you locate each phase, your instructor will verify that you are correct and initial your paper. After you have received verification from your instructor, draw the cell in Table 1.



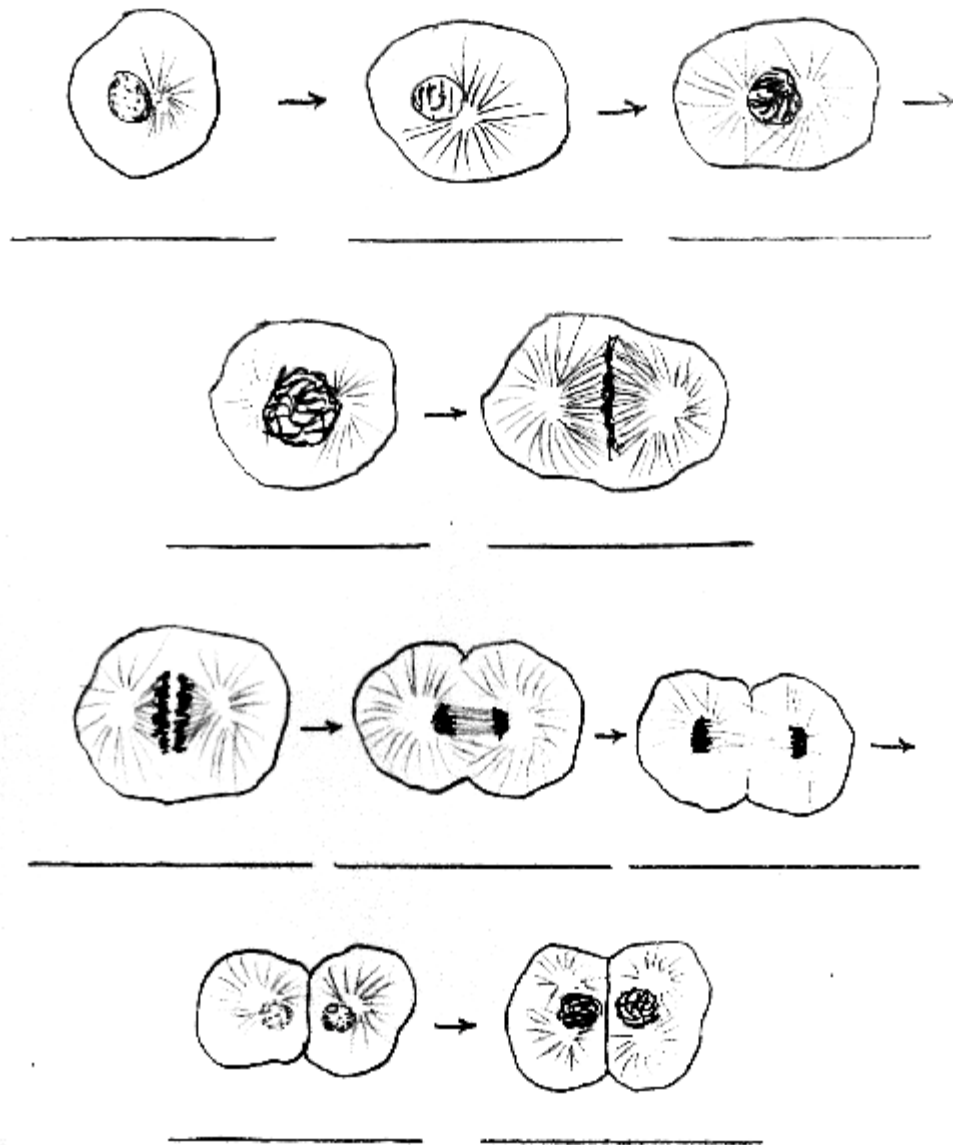


Figure 6: Mitosis in the whitefish blastula.

Questions

1. How does cytokinesis differ between plant cells and animal cells?
2. What specific functions occur during interphase that prepare the cell for division. (These cannot be observed with the light microscope.)
3. Label Figure 7 with the stages of cell cycle (interphase, G1, S, G2, M).



Figure 7: The cell cycle.

Table 1: Find, identify, and draw the phases of mitosis in the onion root tip and whitefish blastula.

Onion Root Tip	Whitefish Blastula
Prophase	Prophase
Metaphase	Metaphase
Anaphase	Anaphase



Telophase	Telophase

About this document ...

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