Name…….. Date…… Period…….

Student Laboratory Packet
Mitosis
A Laboratory Activity for the Living Environment

All new cells come from previously existing cells. New cells are formed by the process of cell division which involves both replication of the cell's nucleus (**karyokinesis**) and division of the cytoplasm(**cytokinesis**).

There are two types of cell division: mitosis and meiosis. **Mitosis** typically results in new somatic (body) cells. Formation of an adult organism from a fertilized egg, asexual reproduction, regeneration, and maintenance or repair of body parts are accomplished through mitotic cell division. **Meiosis** results in the formation of either gametes (in animals) or spores (in plants). These cells have half the chromosome number of the parent cell. Where does one find cells undergoing mitosis? Plants and animals differ in this respect. In higher plants the process of forming new cells is restricted to special growing regions called **meristems**. These regions usually occur at the tips of stems or roots. In animals, cell division occurs anywhere new cells are formed or as new cells replace old ones. However, some tissues in both plant and animals rarely divide once the organism is mature.

Exercise 1: Observing Mitosis in Plant and Animal Cells Using Photographs of Prepared Slides of the Onion Root Tip and Whitefish Blastula

Figure 1 Close up view of different stages of mitosis in an onion root tip:

telophase

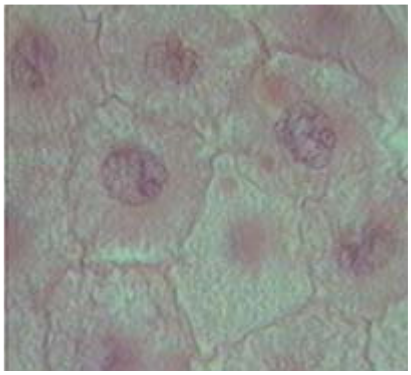
interphase

anaphase

prophase

metaphase

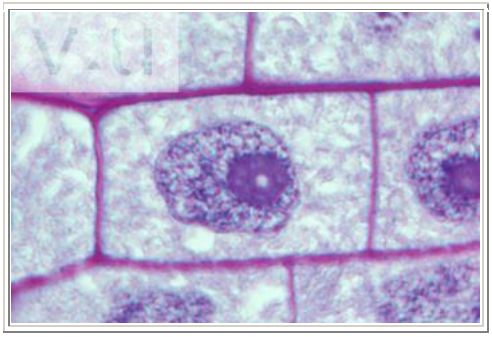
Figure 2 Whitefish Blastula



Procedure

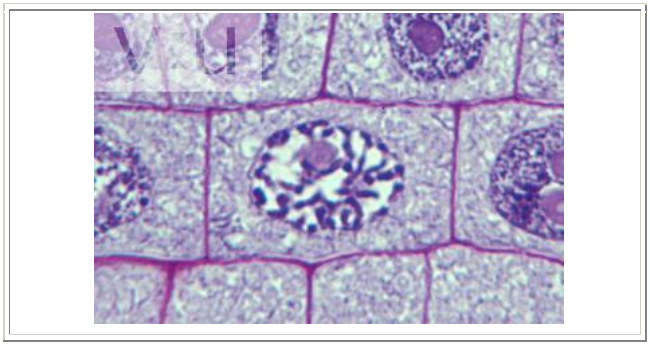
Examine the photographs of prepared slides of either onion root tips or whitefish blastula. Identify one cell which clearly represents each phase of mitosis. These cells are located in the meristematic (growing) region. **Sketch and label the cell in the boxes provided.**

1. The non dividing cell is in a stage called **interphase**. The **nucleus** may have one or more dark-stained **nucleoli** and is filled with a fine network of threads, the **chromatin**. During **interphase**, DNA replication occurs.



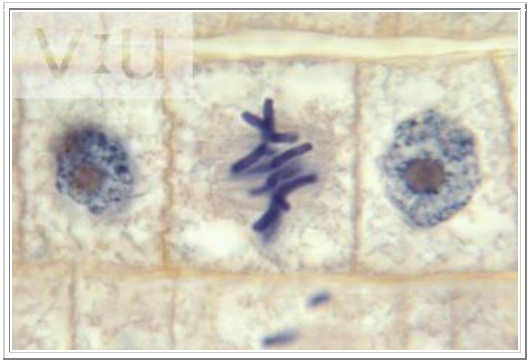
Interphase

2. The first signs of cell division occurs in **prophase**. There is a thickening of the chromatin threads, which will continue until it is evident that the chromatin has condensed into **chromosomes**. With somewhat higher magnification you may be able to see the two **chromatids** held together by the **centromere**. As prophase continues the chromatids continue to thicken and shorten. The nuclear envelope disappears and the beginnings of the spindle apparatus begin to appear.



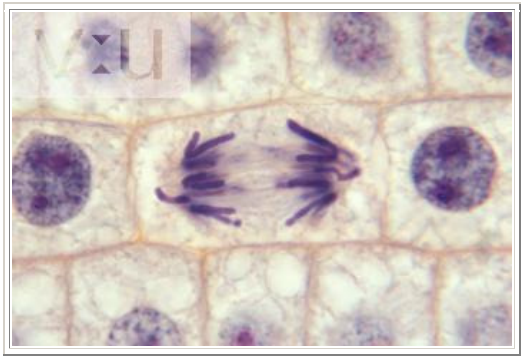
Prophase

3. At **metaphase**, the chromosome pairs have moved to the center of the spindle. One particular part of each chromosome, the centromere, attaches to the spindle. The centromeres of all the chromosomes lie about the same level of the spindle called the **metaphase plate**.



Metaphase

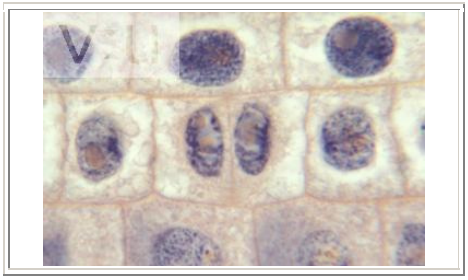
4. At the beginning of **anaphase**, the centromere regions of each pair of chromatids separate and are moved by the spindle fibers toward opposite poles of the spindle, dragging the rest of the chromatid behind them. Once each chromatid is separate it is called a chromosome.



Anaphase

5. **Telophase**, the last stage of division, is marked by a pronounced condensation of the chromosomes, followed by the formation of a new nuclear envelope around each group of chromosomes. The chromosomes gradually uncoil into the fine threads of chromatin, and the nucleoli reappears. **Cytokinesis** may occur. This is the division of the cytoplasm into two new cells. In plants, a new cell wall is laid down between the daughter cells. In animal cells, the old cells will pinch off in the middle along a **cleavage furrow** to form two new daughter cells.

Telophase



Use the photographs in pages 1-3 to make DRAWINGS (in the boxes below) of each phase

interphase

prophase

metaphase

anaphase

telophase

Analysis Questions (use information from page one)

1. There are two types of cell division, what are they? Describe each type?

2. In plants the process of forming new cells occurs where? Where does the process of cell division occur in animals?

Exercise 2: Time for Cell Replication

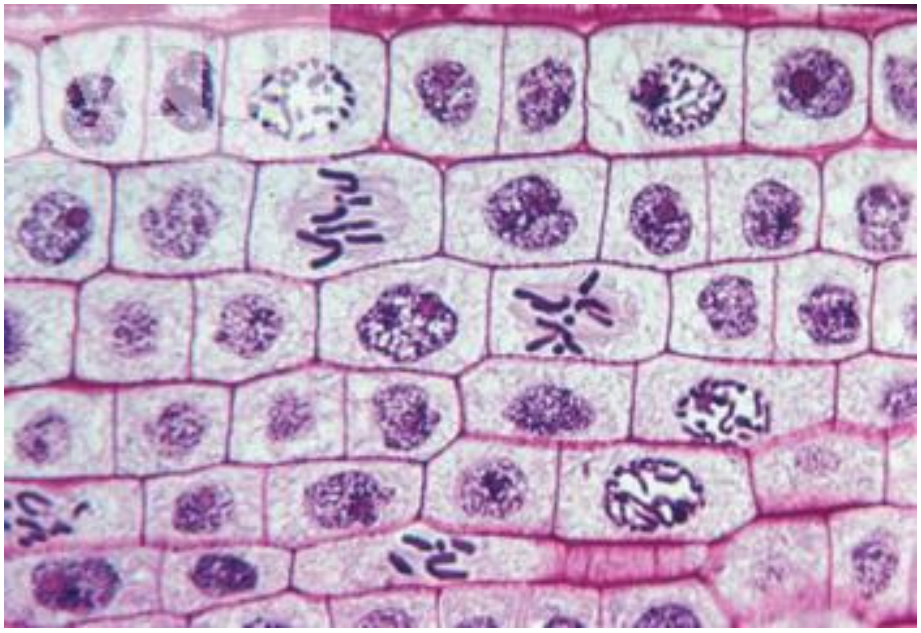
Procedure

It is hard to imagine that you can estimate how much time a cell spends in each phase of cell replication from a slide of dead cells. Yet this is precisely what you are going to do in this part of the lab. Since you are working with a prepared slide photographs, you cannot get any information about how long it takes a cell to divide. What you can determine is how many cells are in each phase. From this, you can infer the percent of time each cell spends in each phase.

1. Observe every cell in the field diagrams in the lab (next page) and determine which phase of the cell cycle each cell is in. Count all three full fields of view and record in the table in the right margin.

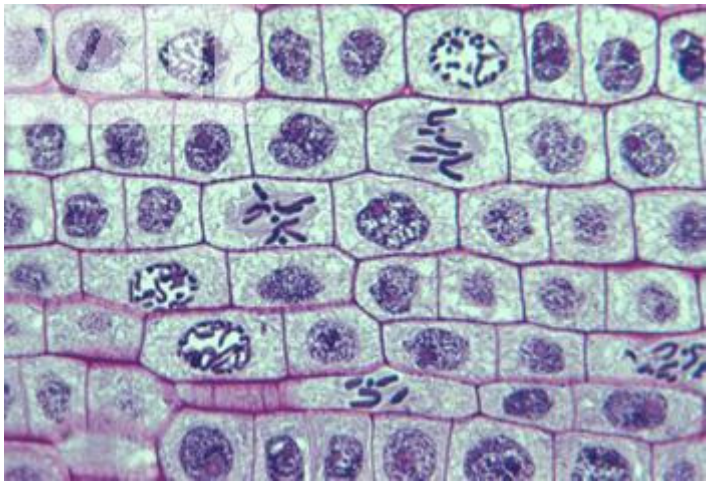
Field One

Interphase	
Prophase	
Metaphase	
Anaphase	
Telophase	
Total # of cells	



Field Two

Interphase	
Prophase	
Metaphase	
Anaphase	
Telophase	
Total # of Cells	



Field Three

Interphase	
Prophase	
Metaphase	
Anaphase	
Telophase	
Total # of Cells	

Table 1

	Number of Cells				Percent of Total Cells Counted	Time in Each Stage
	Field 1	**Field 2**	**Field 3**	**Total**		
Interphase						
Prophase						
Metaphase						
Anaphase						
Telophase						

Total Cells Counted …….

2. Calculate the percentage of cells in each phase.(**Total of each phase divided by Total Cells Counted X 100**)

Consider it takes, on average, 24 hours (or 1,440 minutes) for onion root-tip cells to complete the cell cycle. You can calculate the amount of time spent in each phase of the cell cycle from the percent of cells in that stage.

Percent of cells in stage multiplied by 14.40 = minutes of cell cycle spent in stage.

Analysis Questions

1. If your observations had not been restricted to the area of the plant that is actively dividing or growing, how would your results have been different? **(see page one)**

2. Based on the data in Table 1, what can you conclude about the length of time an onion root-tip cell spends in each stage of cell division? In other words which phase do they spend the most time in?