Cell Reproduction

Why do cells divide?

In order for organisms to grow, cells must be able to reproduce. There also needs to be a way for organisms to repair damaged tissues. In addition, some kinds of living things are able to make clones of themselves in order to increase the population size of their species. For example, amoebas are single-celled organisms and make clones of themselves to create more amoebas; certain plant species do this as well.

When one parent is used to produce offspring, it is called **asexual reproduction.** The offspring are exact genetic copies or **clones** of the parent. Mitosis or mitotic cell division is involved in asexual reproduction and involves cells making a complete copy of their genetic material (DNA). This ensures that when the cell divides into two new daughter cells, each will have a complete copy of the genetic code for their species.

1. Provide three reasons why cells reproduce.

Three reasons why cells reproduce are for growth, repair and to increase the population size of a species.

2. Describe asexual reproduction. How might it differ from sexual reproduction?

Asexual reproduction involves one parent and the offspring are genetic copies to the parent- this process involves mitosis. In sexual reproduction, two parents are involved and the offspring have a combination of traits from both parents.

3. How do the daughter cells of asexual reproduction compare to the parent cell genetically? Explain the role of mitosis here.

Daughter cells of asexual reproduction are genetic copies of their parent. Mitosis involves making a complete copy of the DNA (DNA replication in the nucleus).

Mitotic Cell Division

A cell has a life cycle just like any other living thing. Most of a cell's life is spent carrying out all of the life processes such as respiration, synthesis, digestion etc. This part of the cell's life is known as **interphase.** At a certain point during interphase, a decision is made to enter

into the reproductive process. When this decision is made, the genetic material has to be copied.

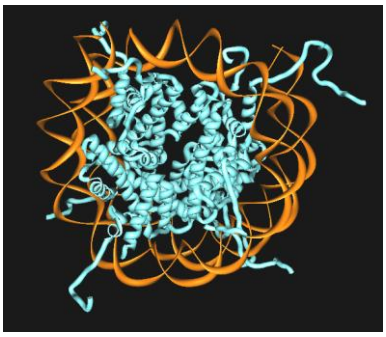
4. Describe interphase and the percentage of a cell's lifespan it comprises.

   The majority of a cell's life cycle is spent in interphase, carrying out all life functions except reproduction.

5. Identify the genetic material in cells that must be copied and its location in the cell.

The DNA must be copied in the nucleus.

As previously discussed, DNA contains the blueprints or instructions for all of the necessary substances such as proteins and all of the life functions. During most of a cell's life, t he DNA is not tightly packed and is referred to as **chromatin.**



The DNA is spread out in this form in order for protein synthesis to occur more easily (remember DNA must unwind and unzip for the transcription of mRNA to occur). When the cell has "decided" that reproduction must occur, the DNA copies itself. Each strand of DNA makes a copy and the two copies are attached by a structure called a centromere. This process of copying the DNA is **replication.**

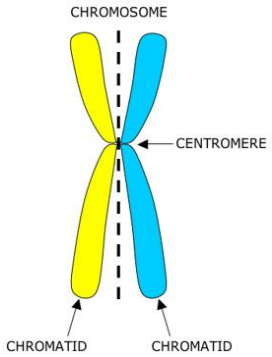
6. What is chromatin?

Chromatin is DNA that is not tightly packed.

7. Define replication.
   Replication is the copying of DNA.

After replication a cell will enter the first stage of mitosis known as **prophase.** During this phase, chromatin shortens and thickens and becomes tightly packed and is now referred to as **chromosomes.** During prophase, chromosomes are visible under the microscope and are double-stranded. Each strand is known as a **chromatid** (chromatid contains the letter "d" and

therefore these are found in double-stranded chromosomes, which also contains the letter "d"). The two chromatids are held together by a centromere.



8. Differentiate between chromosomes and chromatids.

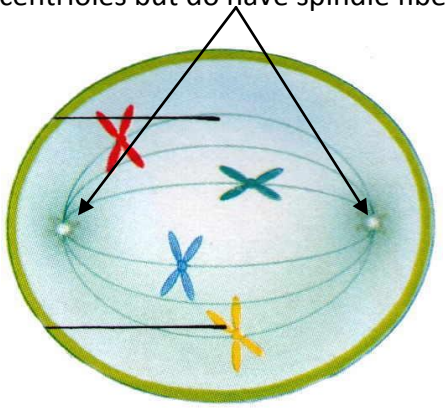
A chromosome is one bundle of genetic material. A chromatid is one strand of a double-stranded chromosome.

The nuclear membrane disintegrates; recall in protein synthesis that DNA is unable to leave the nucleus.

9. Why is it necessary for the nuclear membrane to disintegrate during mitotic division?

The nuclear membrane must temporarily break down in order to let the DNA out so that a complete copy ends up in each daughter cell.

In animal cells, structures called **centrioles** move to opposite ends of the cell and special proteins called **spindle fibers** form to which the chromosomes begin to attach. Plant cells, as you may recall, do not contain centrioles but do have spindle fibers.



In the remaining phases of mitotic division, the double-stranded chromosomes are separated into single strands, which move towards opposite ends of the cell. A new nuclear membrane forms around each set of chromosomes and the cell divides into two.

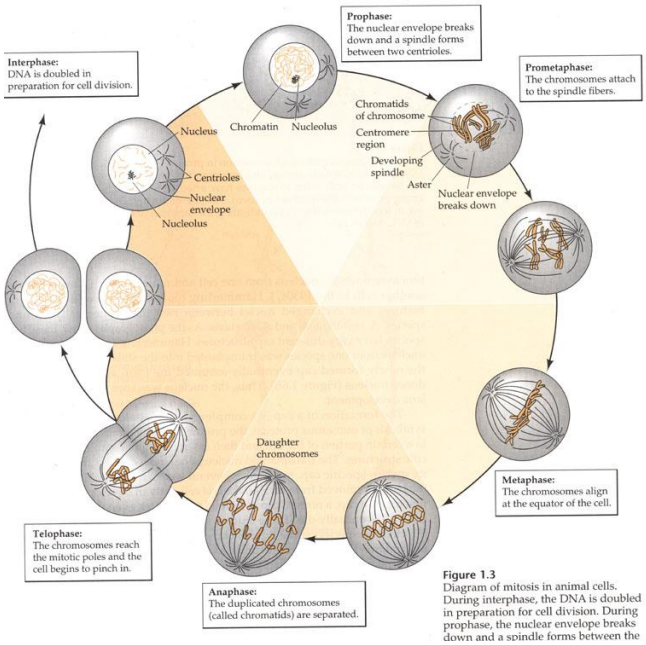
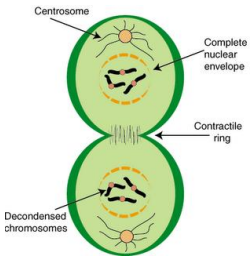
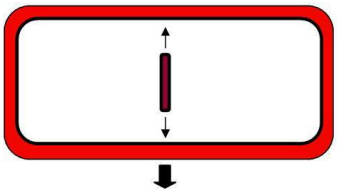


Figure 1.3
Diagram of mitosis in animal cells. During interphase, the DNA is doubled in preparation for cell division. During prophase, the nuclear envelope breaks down and a spindle forms between the

Mitosis is the replication of the nucleus of a cell and at its completion the parent cell contains two complete nuclei. A process known as **cytokinesis** coincides with mitosis, which involves the actual division of the cytoplasm when the cell membrane pinches from the outside in. This process is exclusive to animal cells as plant cells form a structure called a **cell plate**, which divides the cell from the inside out.



Creation of cleavage furrow in animal cell (cytokinesis)



Cell plate formation in plant cell

1. What two events must occur for mitotic cell division to take place?

Nuclear replication (copying DNA in nucleus) and cytoplasmic division must occur for mitotic cell division to take place.

2. Why do you think a cell plate is necessary in plant cells to divide the parent cell in two?

   The rigid cell wall makes it impossible for the plant cell to simply pinch in, therefore the cell plate forms from the center out, partitioning the parent cell into two daughter cells.