Why Do We Reproduce?

Individual organisms have a limited life span. We live and we die. However, life on this planet has continued for millions of years. The ability of organisms to reproduce ensures the continuation of life over vast periods of time. In fact, reproduction is one of the characteristics by which life itself is defined.

The nearly two million known forms of life on Earth reproduce by a bewildering variety of methods. But basically reproduction is either sexual (requiring mating between different sexes) or asexual (requiring no partner to reproduce).

Many other life forms (microorganisms, sponges, worms, and simple plants) reproduce without sex. For example, many single-celled organisms, such as bacteria, reproduce by simply splitting in half (called fission). The single chromosome of a bacterial cell is copied exactly and each new cell formed in fission gets one of the copies. As a result, fission produces bacteria with identical DNA. As fission continues, an entire colony of identical bacteria is formed. The colony is called a clone, a group of genetically identical organisms. Not very exciting? Asexual reproduction, even in more complex creatures, rarely is exciting.

Sexual reproduction, however, is much more interesting than asexual reproduction. It makes possible an almost infinite variety of life. But it is a good deal more involved than a cell simply splitting in half.

Sexual reproduction requires two partners, who must become attracted and find each other compatible. Then, a rather complicated process must take place within the special group of cells that identify one partner as male and the other a female. Though the process has a rather uncommon name, meiosis, it is a very common event in organisms that reproduce sexually.

What Is Meiosis?

Meiosis is the type of cell division that is necessary for sexual reproduction of an entirely new organism. Meiosis generates the sex cells. Meiosis occurs only in the sex organs – the ovaries in females and the testes in males. Every species of animal on Earth has a chromosome number that all normal members of that species share. Meiosis is the process by which the normal chromosome number is cut in half, which makes sexual reproduction possible.

The DNA in your body is contained in the rod-shaped structures called the chromosomes. Most of the cells in your body contain 46 chromosomes. The only cells that contain a different number are the sex cells, which contain half this number, or 23 chromosomes. The male sex cell is the sperm and the female sex cell is the egg. When a sperm cell fertilizes an egg cell, the two cells join. This produces a zygote containing 46 chromosomes. The 46 chromosomes in a zygote contain the DNA that will program the life of the new organism.

As a result of meiosis, the sperm and the egg contain half the number of chromosomes of other cells in the body. Meiosis is necessary to keep the chromosome number constant from one generation to the next. Otherwise, a sperm cell containing 46 chromosomes that fertilized an egg with 46 chromosomes would produce a zygote with 92 chromosomes. Each generation would see a doubling of the chromosome number.

<u>Activity</u>

- Obtain from your teacher 8 pipe cleaners in 2 colors and 2 different lengths, a piece of string and scissors.
- First form 4 pairs of pipe cleaners by twisting together two of the same color and length. Place these inside the loop of string in no special order.
- Imagine that –
    - The 4 pairs of pipe cleaners represent the 4 chromosomes you would see in the nucleus of a fruit fly cell under a good microscope.
    - Chromosomes of different lengths have *completely different* DNA sequences.
    - Chromosomes of the same length but different color have similar DNA sequences. One contains maternal DNA (DNA from the mother); the other contains paternal DNA (DNA from the father).
    - Each single pipe cleaner in a twisted pair represents a chromatid.
    - Chromatids in the same pair carry *identical* DNA sequences. (Chromatids are the result of DNA replication.)
    - The string represents the membrane of the cell nucleus.
- Have your lab partner touch any two pipe cleaners at the same time. Then say whether the chromosomes represented have *completely different* DNA sequences, *similar* sequences, or *identical* sequences. Quiz your lab partner in the same way.
- Using a set of diagrams of a cell undergoing meiosis, properly arrange your pipe cleaners to indicate the position of the chromosomes after each stage of meiosis. Use scissors, when necessary, to cut the string. Form a new loop of string around chromosomes each time a nuclear membrane is reformed.
- Answer the following questions on your paper:

1. In terms of their DNA, how do the cells formed in meiosis compare to the original cell?
2. What process must occur in the new cells to restore them to the conditions of the original cell? How many more pipe cleaners would you need to represent this process?
3. If DNA replication occurs before every cell division, why does the chromosome number of the cell stay the same?