

# Lab: Chromosomes

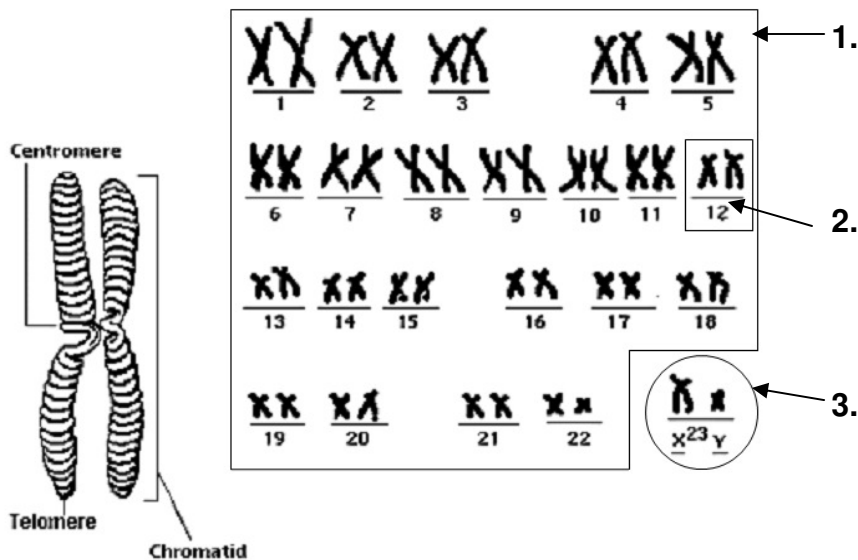
## BIOLOGY

**Background:** You have many types of specialized cells in your body, but they can be divided into two major groups: somatic cells and germ cells. **Somatic cells**, also called body cells, make up most of your body tissues and organs. DNA in your body cells is not passed on to your children. **Germ cells**, in contrast, are cells in your reproductive organs, the ovaries and testes, that develop into gametes. **Gametes** are sex cells (ova, or eggs, in the female, and spermatozoa, or sperm cells, in the male). DNA in your gametes can be passed on to your children.

Each species has a characteristic number of chromosomes per cell. Each of your body cells contains a set of 46 chromosomes, which come in 23 pairs. One of each pair comes from your mother and the other from your father. These pairs are referred to as **homologous chromosomes** and have the same length and general appearance. More importantly, these chromosomes have copies of the same genes, although the two copies may differ.

A **karyotype** is an organized profile of a person's chromosomes. In a karyotype, chromosomes are arranged and numbered by size, from largest to smallest. This arrangement helps scientists quickly identify chromosomal alterations that may result in a genetic disorder. To make a karyotype, scientists take a picture of someone's chromosomes, cut them out and match them up using size, banding pattern and centromere position as guides. Collectively, chromosomes 1-22 make up your **autosomes**, chromosomes that contain genes for characteristics not directly related to the sex of an organism. The 23rd pair is known as your **sex chromosomes** and control the development of sexual characteristics.

Identify the items in the karyotype and explain their characteristics.



Body cells and gametes have different numbers of chromosomes. Your body cells are diploid. **Diploid** means a cell has two copies of each chromosome: one copy from the mother, and the one copy from the father. Diploid cells can be represented as **2n**. In humans, the diploid chromosome number is 46. Gametes are not diploid cells; they are **haploid** cells, represented as **n**. Haploid means that a cell has only one copy of each chromosome. Each human egg or sperm cell has 22

**autosomes** and 1 **sex chromosome** for a total of 23. Germ cells in your reproductive organs undergo the process of **meiosis** to form gametes. Meiosis is a form of nuclear division that divides a diploid cell into haploid cells.

Complete the chart below describing the differences between the process of **meiosis** and **mitosis** (refer to page 171)

MITOSIS		MEIOSIS	
Diagram			Diagram
	Produces-	Produces-	
	Results in-	Results in-	
	Takes place in-	Takes place in-	
	Involved in-	Involved in-	

### ACTIVITY: Modeling Chromosomes in Mitosis and Meiosis

In this activity you will be looking at the chromosomes of the imaginary Leksak bird. You will determine what type of change occurs in the number of chromosomes when a cell divides by mitosis and meiosis.

#### Procedure/Data and Observations

1. Cut out each chromosome model in Figure 1
2. Fold each paper model in half along dotted lines.
3. Match in pairs as many chromosomes models as possible. A chromosome pair must match in length as well as in number and location of genes. The lines on the chromosome models represent genes.
4. Answer questions 1-4 in Questions and Conclusions before proceeding further.
5. Cut each chromosome model in half along the dotted line. Make two piles of chromosome halves. Put one half of each chromosome in one pile and the other half in the second pile.
6. Compare the chromosomes in the first pile with those in the second pile.
7. Before proceeding, answer questions 5 and 6 in Questions and Conclusions.

A process of cell division called **mitosis** occurs in most living things. During mitosis, one cell divides to produce two cells. The cutting of each chromosome model and separating them into two piles is similar to what happens in a living cell. The two piles of chromosome models represent two new cells. (Each chromosome duplicates itself and the two halves then separate.)

8. *Place all identical chromosome models together in separate groups. You should have six groups of models.*
9. *Take a group of matched chromosomes and separate them into four piles. Take a second group of matched chromosomes and place one chromosome from the group into each of the four piles.*
10. *Continue this sorting until all chromosome models, including the unmatched chromosome models, have been separated into the four piles. Each pile of chromosome models represents a sex cell.*

A process of cell division called **meiosis** occurs in most living things. During meiosis, one cell divides to produce four cells. Each new cell produced by this process is called a **sex cell** (egg or sperm cell)

## Questions and Conclusions

1. How many chromosomes can be found in each of the Leksak bird's cells?
2. How many matched pairs of chromosomes are there in each cell?
3. How many unmatched chromosomes are there in each cell?
4. Do the genes on each matched pair of chromosomes also match?
5. After separating the chromosome model halves into two piles, how many models are found in each pile?
6. How many chromosomes are found in Leksak sex cells?
7. Do any chromosomes match one another in a sex cell?
8. Male Leksak birds have six matched pairs of chromosomes and two unmatched chromosomes. Female Leksak birds have seven matched pairs of chromosomes. Were the chromosomes in our bird taken from a male or female?
9. Are all cells produced by mitosis exactly alike, chromosome for chromosome? Gene for gene? Explain why?

10. How does the number of chromosomes in sex cells compare to the number of chromosomes in cells formed during mitosis?

11. Explain two ways in which sex cells differ from all other cells.

12. What is the difference between somatic cells and germ cells?

13. What processes takes place in somatic and germ cells and how do the resulting cells compare to the original cell?

14. Mitosis produces cells that are \_\_\_\_\_ and meiosis produces cells that are \_\_\_\_\_.

15. What evolutionary advantage would sexual reproduction (meiosis) have over asexual reproduction with Earth's ever-changing conditions?

16. Look at the following karyotype. What abnormalities do you see? What is this genetic disorder called?

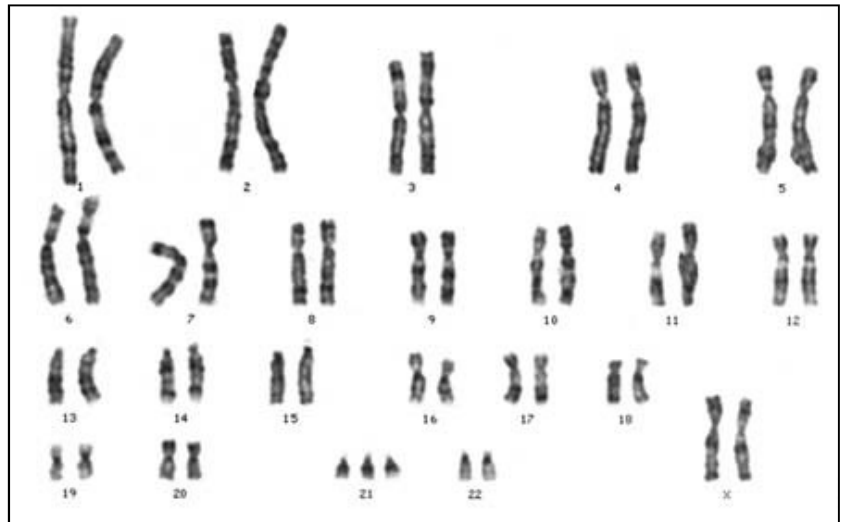


FIGURE 1

