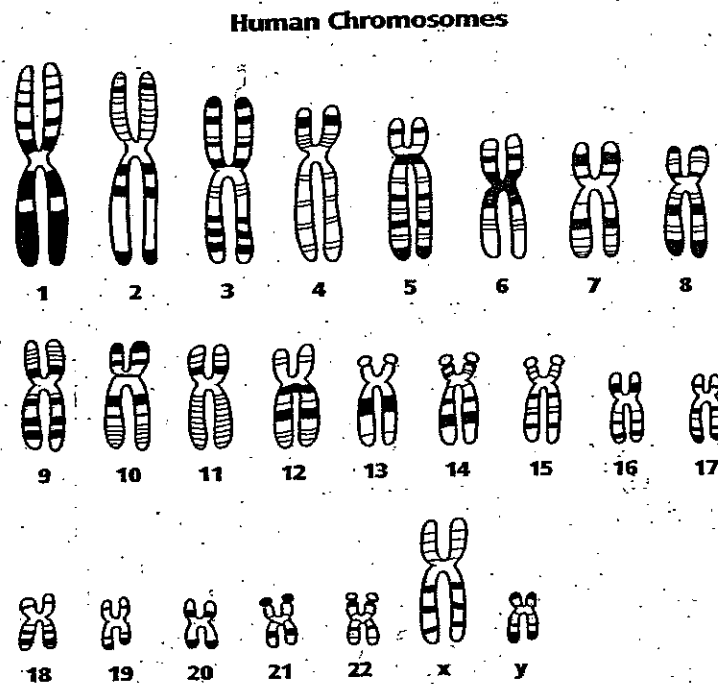


# KARYOTYPING

## Introduction

Humans have 46 chromosomes in every diploid ( $2n$ ) body cell. The chromosomes of a diploid cell occur in homologous pairs, which are pairs of chromosomes that are similar in size, shape, and the position of their centromere. In humans, 22 homologous pairs of chromosomes are called autosomes. The twenty-third pair, which determines the individual's sex, make up the sex chromosomes. Females have only one type of sex chromosome, which is called an X chromosome. Males have two types of sex chromosomes, an X chromosome and a much smaller Y chromosome. The diagram below shows each of the 22 types of autosomes and the 2 types of sex chromosomes.



A karyotype is a diagram that shows a cell's chromosomes arranged in order from largest to smallest. A karyotype is made from a photo taken through a microscope of the chromosomes from a cell. The photographic images of the chromosomes are cut out and arranged in homologous pairs by their size and shape. The karyotype can be analyzed to determine the sex of the individual and whether there are any chromosomal abnormalities. For example, the karyotype of a female shows two X chromosomes, and the karyotype of a male shows an X chromosome and a Y chromosome.

Chromosomal abnormalities often result from the failure of chromosomes to separate properly during meiosis. Cells may result in having too many or too few chromosomes. Down syndrome is a chromosomal abnormality that results from having an extra number 21 chromosome.

## Procedure

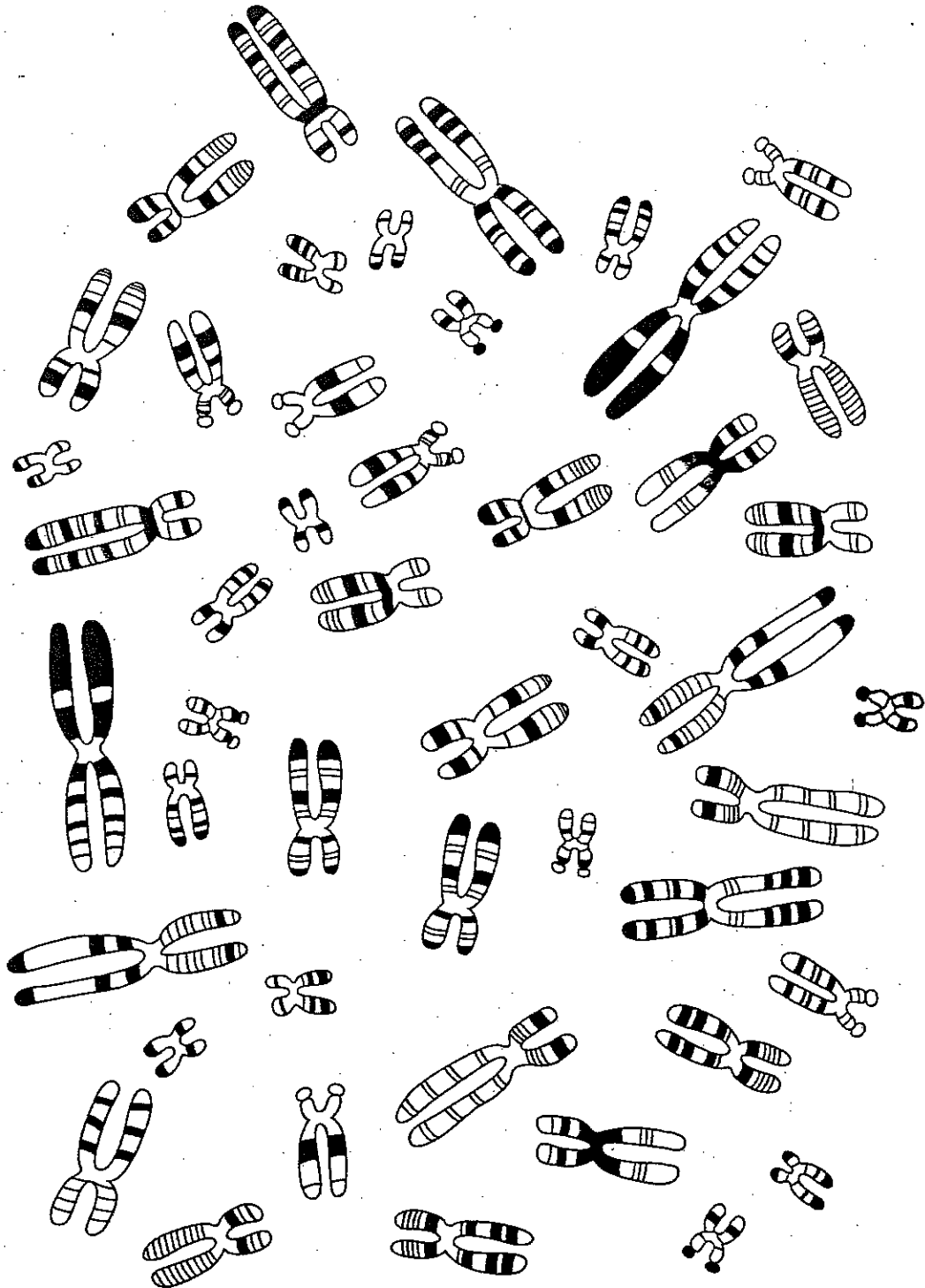
1. Carefully cut each chromosome from the chromosome spread.
2. Arrange the chromosomes in homologous pairs (pairs of chromosomes that are similar in size, shape, and position of their centromere.) Arrange the pairs according to their length, from largest to smallest. The banding patterns of the chromosomes may also help you to pair up the homologous chromosomes.
3. Tape each homologous pair to the Human Karyotyping Form, positioning the centromeres on the lines. Place the pairs in order, with the longest pair at position 1, the shortest pair at position 22, and the sex chromosomes at position 23.
4. You have made a karyotype!

## Analysis

Suppose that you are a medical lab technician, and one of your jobs is to assist with prenatal testing. Mrs. Smith is pregnant, and the karyotype that you have created is from the cells of Mr. and Mrs. Smith's unborn baby.

1. Mr. and Mrs. Smith want to know whether they are having a boy or a girl. Is the unborn child male or female? How do you know?
2. Mr. and Mrs. Smith want to know whether their baby is normal or has Down Syndrome. What would you tell them?
3. Why are karyotypes important tools for geneticists?

# HUMAN CHROMOSOME SPREAD



# HUMAN KARYOTYPE CHART

1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	<u>Sex Chromosomes</u>	

Number of Chromosomes: \_\_\_\_\_ Sex of Subject: \_\_\_\_\_ Type of Disorder \_\_\_\_\_