**Lab # _____ Karyotype**

Lab Instructor _____ Name _____
Date _____ Period _____

***Objective: To construct and analyze a karyotype***

**** Use full sentences when answering all questions. ****

## Background

Humans have 46 chromosomes in each somatic cell (diploid or 2n). The chromosomes of a diploid cell occur in homologous pairs, that is, pairs of chromosomes that carry the same genes and are similar in size, shape, and the position of the centromere. In humans, there are 22 homologous pairs of chromosomes called autosomes. The autosomes are numbered from 1 to 22. The 23rd pair, which determines the individual's sex, is made up of the sex chromosomes. Females have two X chromosomes, and males have one X chromosome and one much smaller Y chromosome.

A karyotype is a diagram of all of the homologous pairs of chromosomes from one cell arranged from largest to smallest. To make a karyotype, cells in metaphase are stained in order to show characteristic banding patterns of each chromosome. Then a photograph of the chromosomes is taken through the microscope. The photograph is called a chromosome spread (see the chromosome spread page). The picture of each chromosome is then cut out and the homologous pairs are arranged in size order. Each chromosome can be identified by its size, shape and characteristic banding pattern.

A karyotype is used as a tool to look for large genetic abnormalities such as missing or extra chromosomes. A karyotype is usually made to diagnose a fetus or a new born baby. Trisomy is an abnormality in which cells have one extra chromosome.

## PRE-LAB

1. What is a karyotype, and what is its use?

2. To make a karyotype, the cells used are in what phase of mitosis? Have the chromosomes in this phase of mitosis been replicated yet? Are these chromosomes diffuse or condensed?

3. What is the name of a procedure in which fetal cells are obtained for prenatal testing? What type of doctor performs this procedure?

## LAB

### Materials

1. Diagram identifying each human chromosome
2. Diagram of a chromosome spread
3. Blank karyotype form
4. scissors
5. glue or tape

### Procedure

1. Carefully cut out each chromosome from the chromosome spread. (DO NOT CUT THE DIAGRAM THAT IDENTIFIES EACH CHROMOSOME BY NUMBER.)
2. Arrange the chromosomes in homologous pairs. Homologues will have the same length, centromere position and banding pattern.
3. Identify each homologous pair's number using the diagram provided as a guide.
4. Adhere each homologous pair at the correct numbered position on the Human Karyotype Form.
5. Dispose of all paper scraps in appropriate recycling bins.
6. Analyze the karyotype for sex and chromosome number.

Name _____

Period _____

## Observations

1. How were you able to determine that two chromosomes are homologous?

2. How did you identify the sex chromosomes?

3. How many chromosomes does your karyotype contain?

4. Which sex chromosomes are present?

## POST-LAB/CONCLUSIONS

1. Did your chromosome spread contain the normal number of chromosomes? Explain. What is the sex of this person? How do you know?

2. When writing a diagnosis from a karyotype, first write the total number of chromosomes, and then indicate the sex chromosomes present. For example, a normal male is written 46,XY and a girl with trisomy 21, that is, three chromosome 21 instead of only two, is written 47,XX+21. In the chart below, fill in the correct karyotypes.

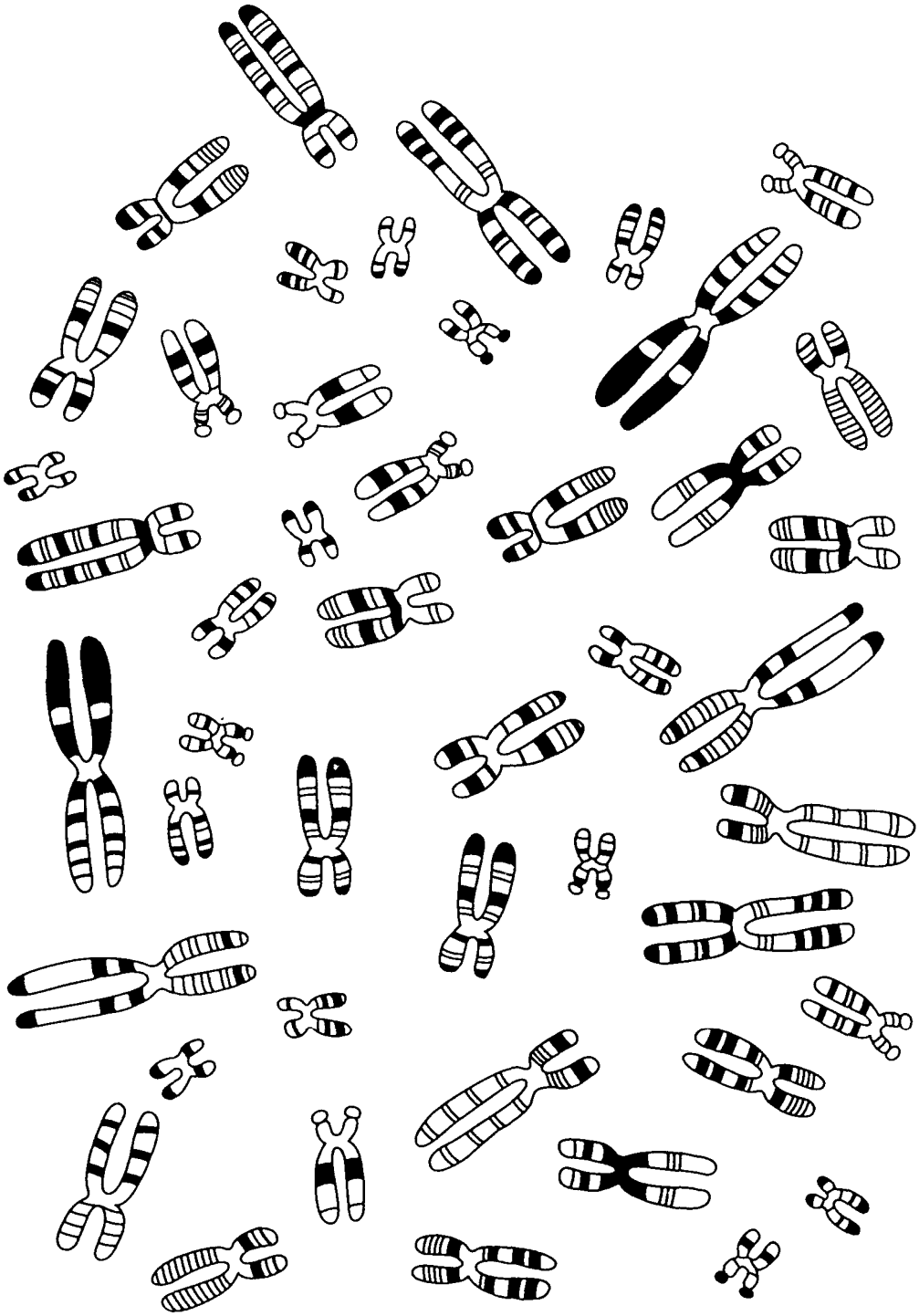
| NAME OF ABNORMALITY | KARYOTYPE | CHROMOSOMES PRESENT | SYMPTOMS |
|---|---|---|---|
| Down Syndrome or Trisomy 21 | 47,XX+21 or 47,XY+21 | an extra chromosome 21 | mental retardation with specific facial features, often heart defects |
| Edward Syndrome or Trisomy 18 | | an extra chromosome 18 | severe mental retardation, malformations of skull, death at infancy |
| Patau Syndrome or Trisomy 13 | | an extra chromosome 13 | severe mental retardation, facial malformations, death at infancy |
| Turner Syndrome | | only one X chromosme, other sex chromosome is missing | female but does not develop secondary sex characteristics, are infertile |
| Klinefelter Syndrome | | extra X in male | male, tall, sterile |
| Triple X Syndrome | | extra X in female | female, sterile |

3. How could you make the diagnosis of one of the above abnormalities from a karyotype?

4. Name and describe the error during meiosis that could result in a gamete with a missing or extra chromosome.

# CHROMOSOME SPREAD

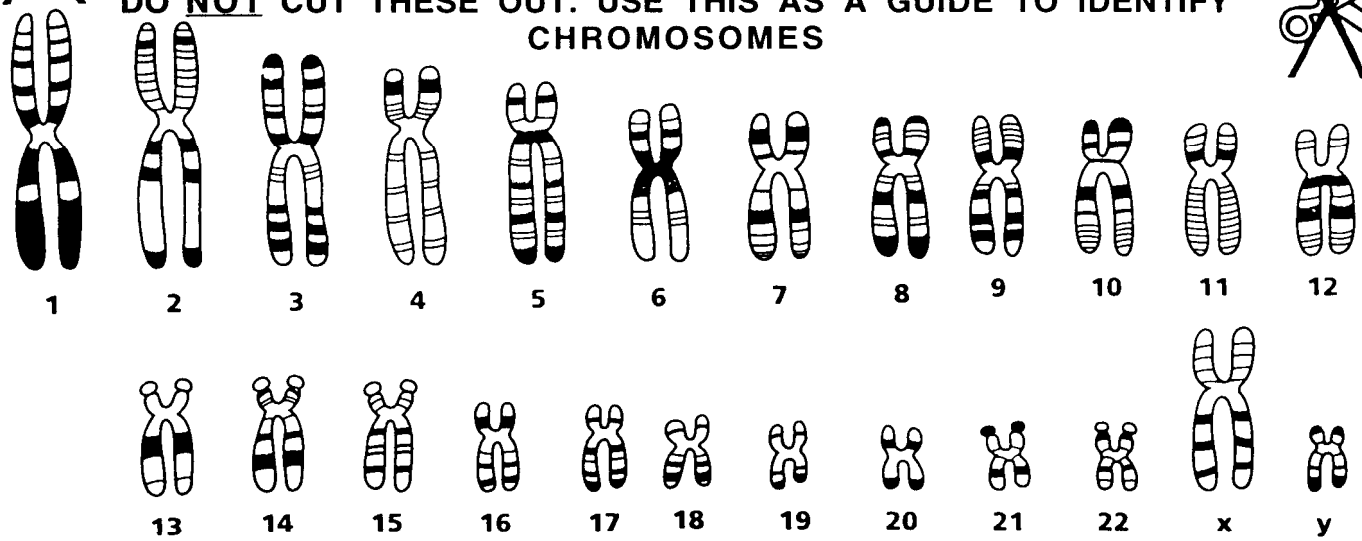
**CUT THESE OUT AND ADHERE TO KARYOTYPE FORM**



Name _____

# YOUR GUIDE: DIAGRAM OF HUMAN CHROMOSOMES

**DO NOT CUT THESE OUT. USE THIS AS A GUIDE TO IDENTIFY CHROMOSOMES**




## HUMAN KARYOTYPE FORM

**ADHERE HOMOLOGOUS PAIRS TO THE CORRECT POSITION**

_____ _____ _____ _____ _____ _____ _____ _____

1 2 3 4 5 6 7 8

_____ _____ _____ _____ _____ _____ _____ _____

9 10 11 12 13 14 15 16

_____ _____ _____ _____ _____ _____ _____ _____

17 18 19 20 21 22 X Y