Name_____ Class_____ Date _____

Making Karyotypes

Introduction

Several human genetic disorders are caused by extra, missing, or damaged chromosomes. In order to study these disorders, cells from a person are grown with a chemical that stops cell division at the metaphase stage. During metaphase, a chromosome exists as two chromatids attached at the centromere.

The cells are stained to reveal banding patterns and placed on glass slides. The chromosomes are observed under the microscope, where they are counted, checked for abnormalities, and photographed. The photograph is then enlarged, and the images of the chromosomes are individually cut out. The chromosomes are identified and arranged in homologous pairs. The arrangement of homologous pairs is called a karyotype. In this investigation, you will use a sketch of chromosomes to make a karyotype. You will also examine the karyotype to determine the presence of any chromosomal abnormalities.

Problem

How can chromosomes be observed?

Pre-Lab Discussion

Read the entire investigation. Then work with a partner to answer the following questions.

1. What clues to the presence of certain genetic disorders can be seen in a karyotype?

_____

2. Why might a laboratory worker attempting to diagnose a genetic disorder prefer to work with photographs of chromosomes rather than the chromosomes themselves?

_____

_____

3. Why would it be much more difficult to construct a karyotype of unstained chromosomes?

_____

4. Which pair of chromosomes can contain two very different chromosomes and still be considered normal? Explain your answer.

_____

_____

5. How do autosomes differ from sex chromosomes?

_____

_____

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Materials *(per student)*

scissors glue or transparent tape

Safety

Be careful when handling sharp instruments. Note all safety alert symbols next to the steps in the Procedure and review the meaning of each symbol by referring to Safety Symbols on page 8.

Procedures

Part A. Analyzing a Karyotype

1. Observe the normal human karyotype in Figure 1. Notice that the two sex chromosomes, pair number 23, do not look alike. They are different because this karyotype is of a male, and a male has an X and a Y chromosome.

Gender?

Any defects?

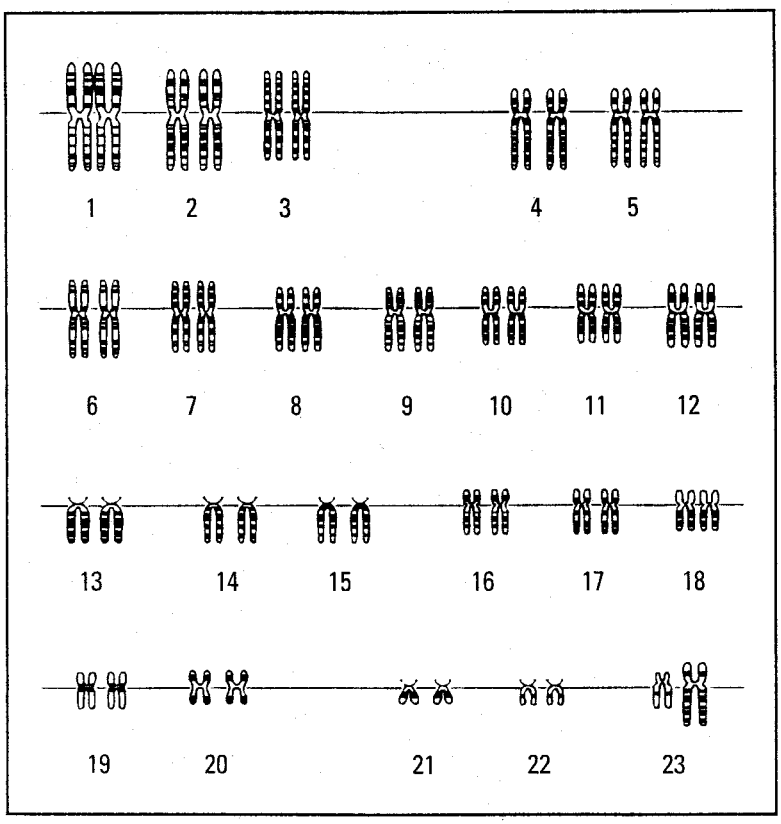

Figure 1

2. Identify the centromere in each pair of chromosomes. The centromere is the area where each chromosome narrows.

Part B. Using a Karyotype to Identify a Genetic Disorder

1. Study the human chromosomes in Figure 2 on page 125. Notice that 23 chromosomes are numbered 1 through 23.
2. To match the homologous chromosomes, look carefully at the unnumbered chromosomes. Note their overall size, the position of the centromere, and the pattern of the light and dark bands. Next to the unnumbered chromosome that is most similar to chromosome 1, write 1.
3. Repeat step 2 for chromosomes 2 through 23.

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4. Use scissors to cut out all the chromosomes from Figure 2. Tape them in their appropriate places in Figure 3. Note any chromosomal abnormalities. **CAUTION:** *Be careful when handling sharp instruments.*

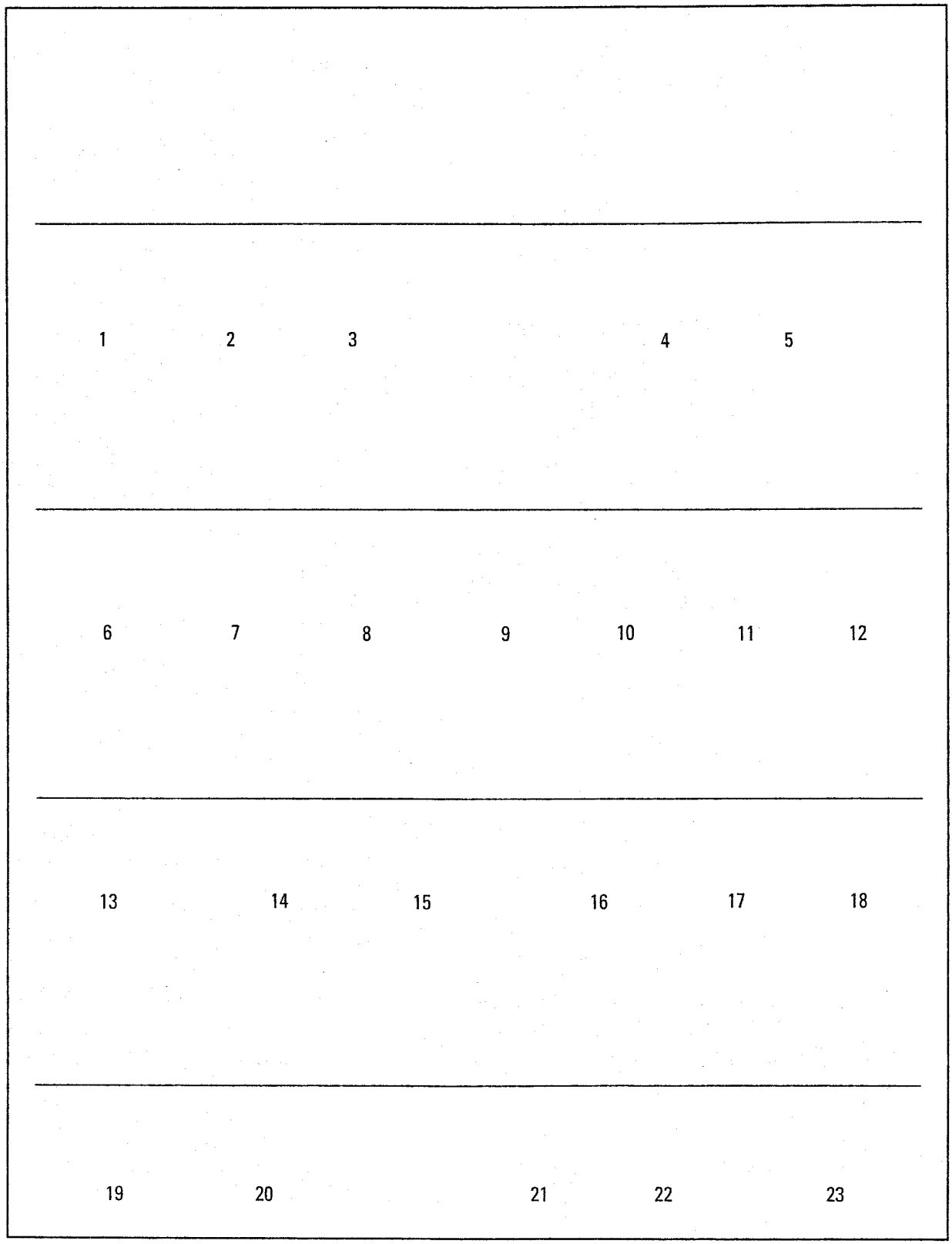

Figure 3

Gender?

Any defects?

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5. Observe the karyotypes in Figures 4 and 5. Note the presence of any chromosomal abnormalities.

Gender?

Any Defects?

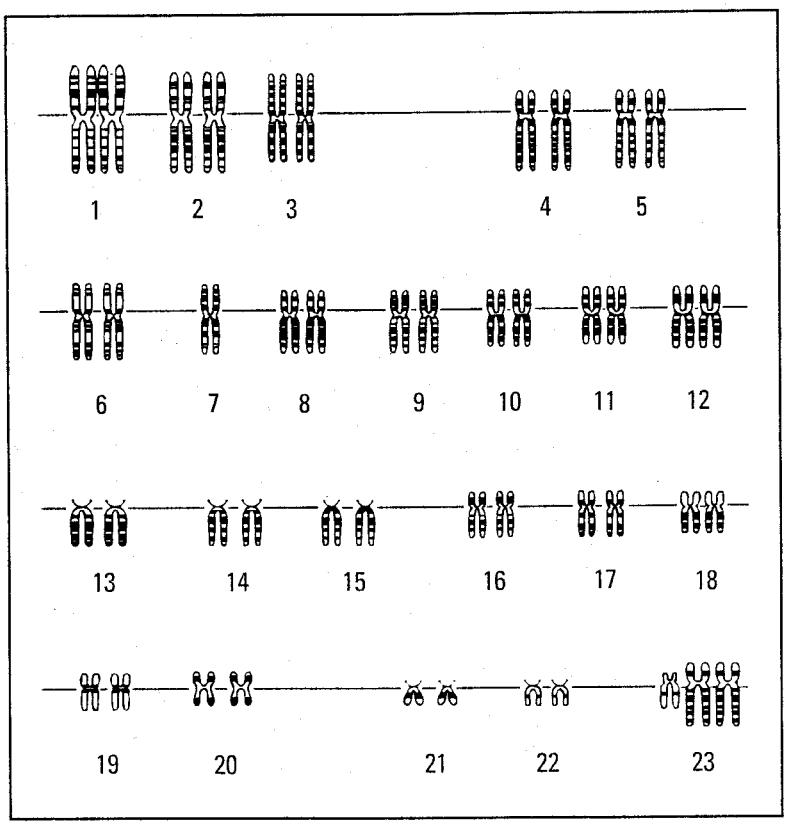

Figure 4

Gender?

Any defects?

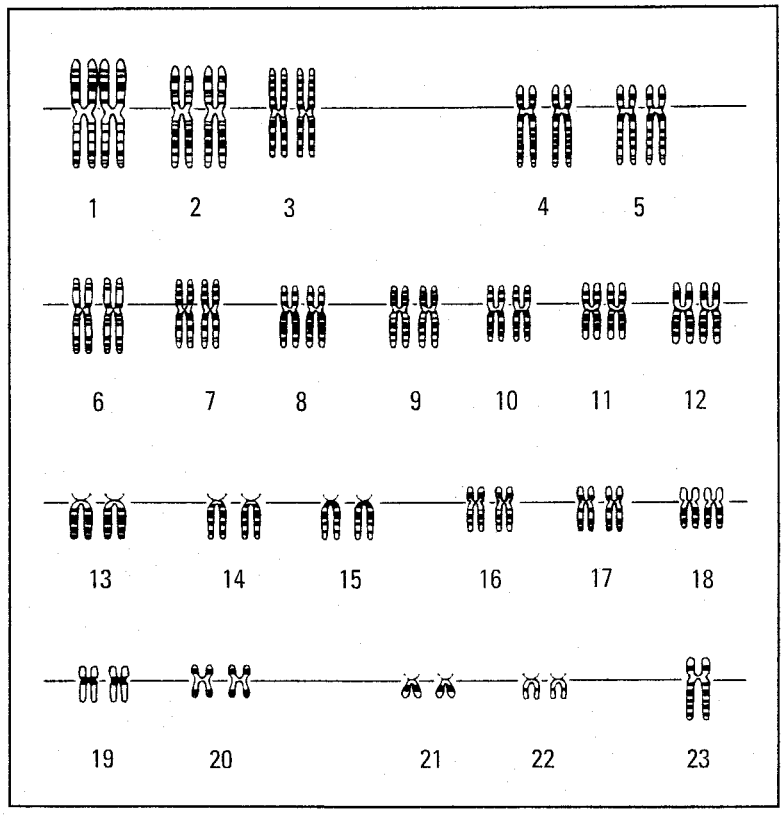

Figure 5

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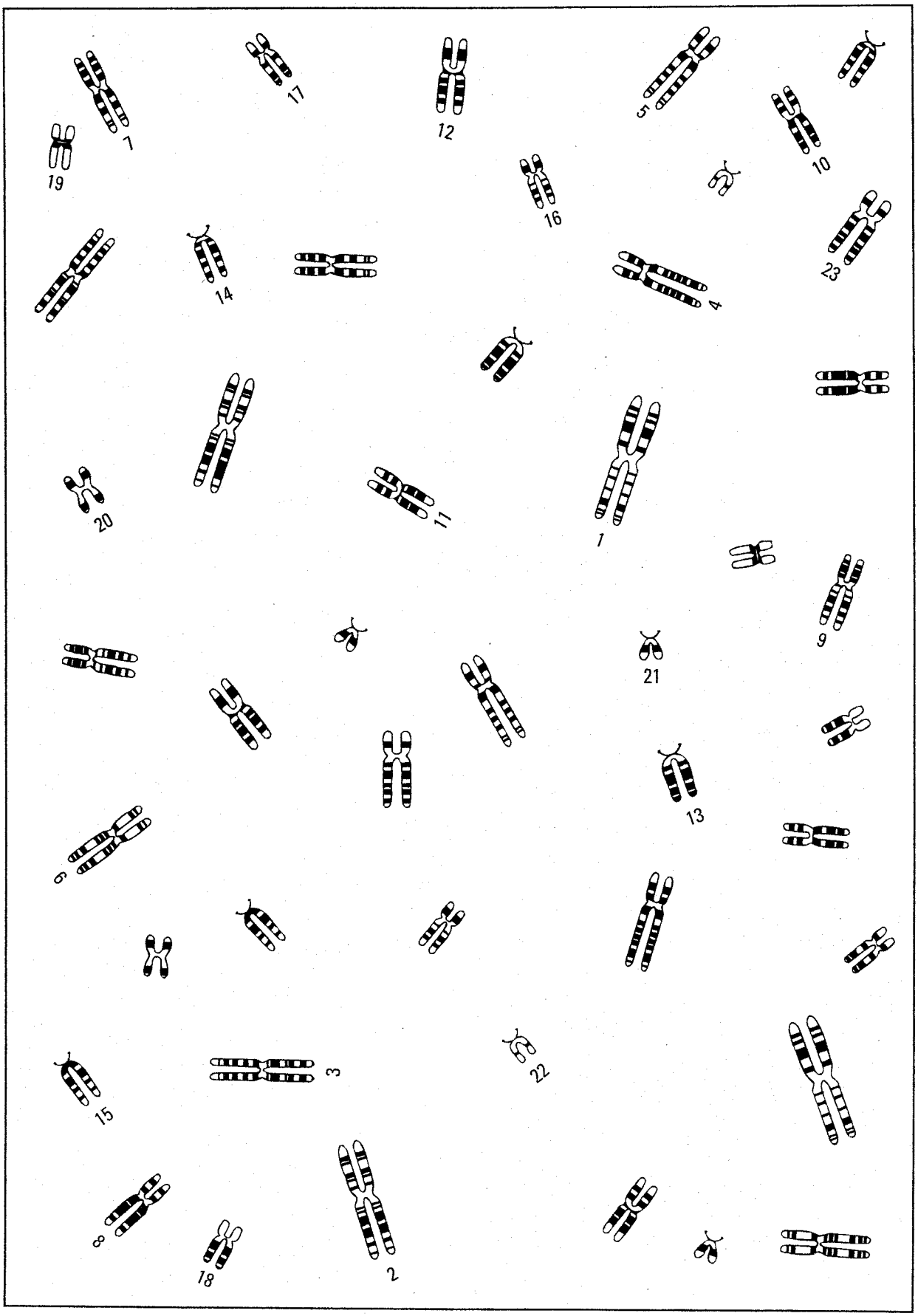

Figure 2

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