2. Figure 13.2 shows a chart of human chromosomes from a person with a genetic disorder. The banding patterns, sizes, and position of the centromeres are the same as those in Figure 13.1, but something is different. Photocopy the chart, then cut out the chromosomes. CAUTION: *Handle scissors with care.* Arrange the chromosomes in matching pairs, using Figure 13.1 as a guide.

3. Make a karyotype by gluing or taping the chromosomes onto a piece of blank paper. Compare the karyotype you made with the karyotype shown in Figure 13.1.

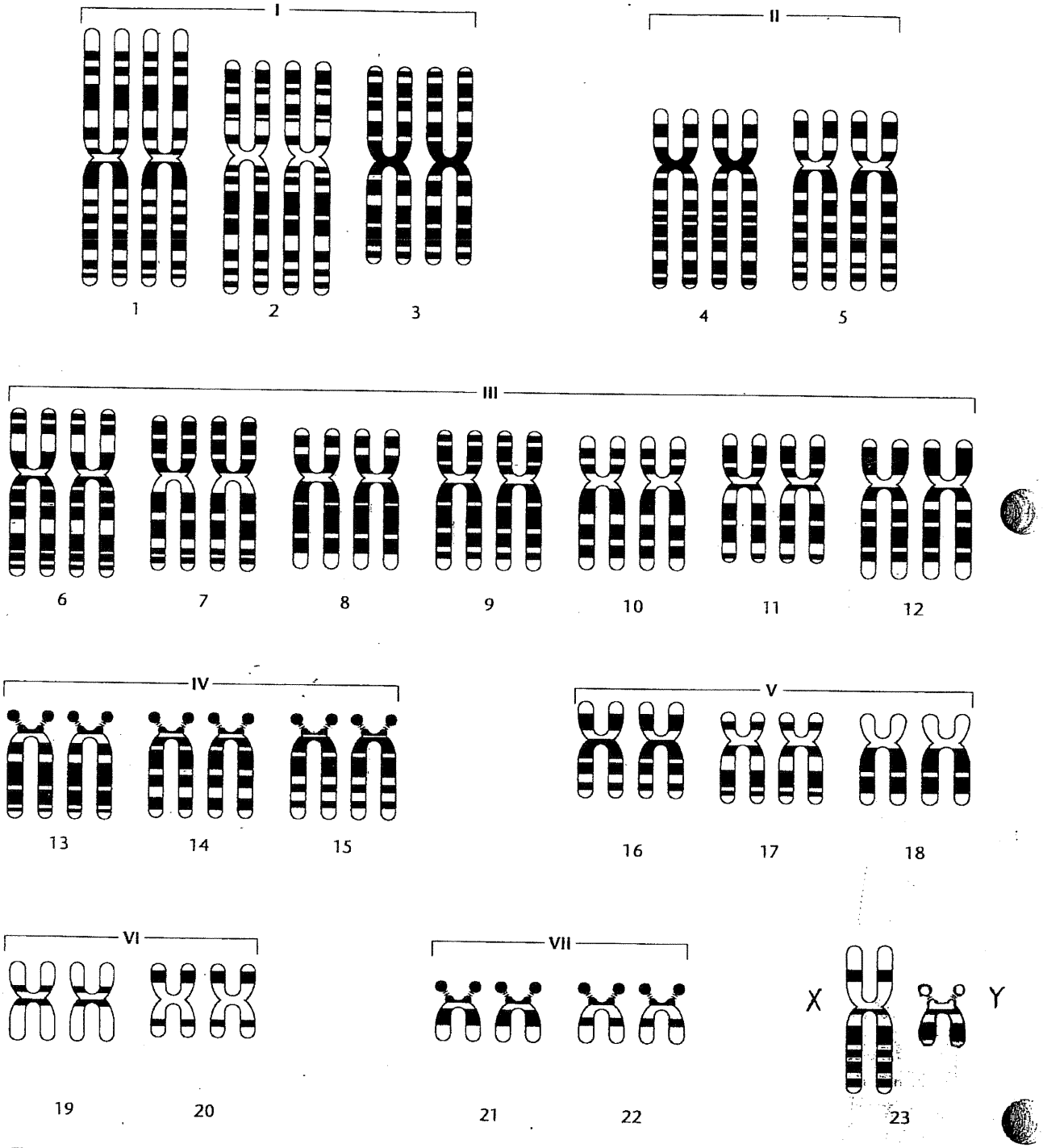

Figure 13.1.

Name: _____ Class: _____ Date: _____

Laboratory Notebook Clues from the Karyotype

Hypothesis: _____

_____

Data Record

Write your name, class, and today's date on a blank piece of paper. The chart you construct will be the Data Record for this lab.

Analyses and Conclusions

1. IDENTIFY the karyotype in Figure 13.1. Is it that of a male or a female? How can you tell?

_____

2. EXPLAIN why you think banding patterns might be an important way to make sure that two chromosomes are truly homologous.

_____

_____

3. IDENTIFY the karyotype you constructed. Is it that of a male or a female? How can you tell?

_____

4. OBSERVE and count the number of chromosomes in the karyotype you constructed. How does it differ from the karyotype in Figure 13.1? Can you IDENTIFY the disorder?

_____

5. EVALUATE your hypothesis. What evidence do you have to support or reject it? If your hypothesis was incorrect, how could you RESTATE it?

_____

6. EXPLAIN what might cause a person to inherit the wrong number of chromosomes.

_____

_____

7. INFER why you think it is harmful for a person to have too few or too many chromosomes.

_____

_____

A Step Further

Research other genetic disorders in humans that are diagnosed by karyotyping. Describe how the karyotypes for these disorders differ from the normal karyotype. What effect do these disorders have on the individuals who have them?

LAB 13 Clues from the Karyotype

Inquiry: *How can a karyotype be used to identify chromosomal abnormalities in humans?*

Introduction: Karyotyping is the way geneticists identify, organize, and study human chromosomes. Cells are taken from tissue and made to reproduce in a culture. The cells are then treated with a chemical that stops mitosis at metaphase. At this stage of cell division, the chromosomes are easiest to observe.

The cells are stained for examination under a microscope, and the chromosomes are photographed. The photo is enlarged and the individual chromosomes are cut out. Normally, there are 22 autosomes and one pair of sex chromosomes. They are divided into seven groups according to their length and the position of their centromeres.

Geneticists then look at the distinctive banding patterns created after the chromosomes have been stained. They use these patterns to help them organize the chromosomes into *homologous*, or matching, pairs. This arrangement of chromosomes is called a *karyotype*. Geneticists use karyotypes to determine the sex of a person. They also can use them to see whether a person has a genetic disorder. In this lab, you will study a karyotype and analyze the information it provides.

Objectives:
- OBSERVE similarities and differences among human chromosomes.
- CONSTRUCT a karyotype.
- INFER chromosomal abnormalities from a karyotype.

Prelab Activities

Concepts: Review sections in your text that explain the processes of mitosis, meiosis, and cell division. In a given body cell, do all 23 pairs of chromosomes match each other? Which pair might not match? Recall that before a cell reproduces, its chromosomes duplicate. The duplicated chromosomes are joined at their centromeres. What kinds of errors can take place during cell reproduction? How can these errors lead to genetic disorders? Formulate a hypothesis of how a karyotype can be used to identify genetic disorders in humans.

Tech Talk: Be sure you understand the meaning and use of the following words before proceeding with the lab.

karyotyping	culture	centromere	homologous
chromosomes	metaphase	mitosis	autosome

Materials

scissors glue or tape blank sheet of paper

Procedure

1. Study the normal karyotype of human chromosomes in Figure 13.1. Notice that the chromosomes are arranged in pairs, which are numbered. Observe their shapes and sizes, and see that the banding patterns of each pair all differ from every other pair. Note whether all the pairs match.