6900 HUMAN KARYOTYPE KIT
Student Guide

BACKGROUND

As methods of investigation have improved over the years, geneticists have been able to analyze and map chromosomes. The process of culturing white blood cells and arresting them at the metaphase stage of mitosis is one of these methods. At this particular stage of cell division each chromosome is doubled, and the strands are connected by a centromere. Scientists can observe and study these chromosomes to determine if they are normal or abnormal. A normal set of human chromosomes is shown in Figure 1.

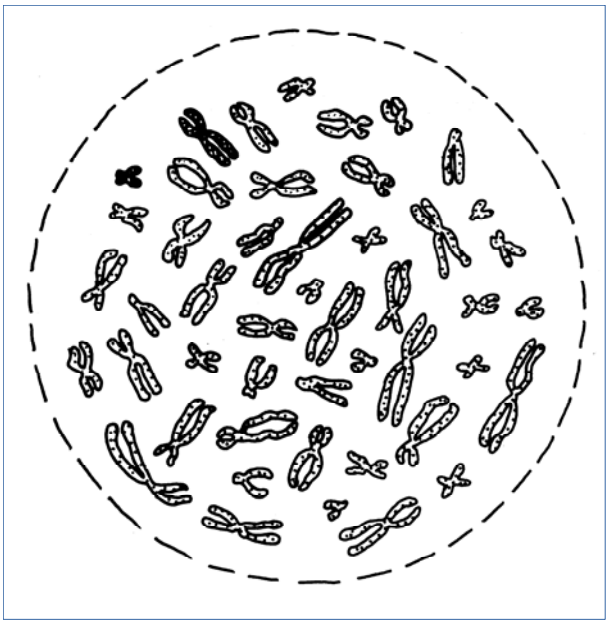


Figure 1 Nucleus at the metaphase state.

Chromosome pairs can be arranged in a sequence know as a *karyotype* (see Figure 2), by classifying the chromosomes into groups according to the length of the strands and the location of the centromere. Each like pair of chromosomes (autosome pair) is arranged in one of seven groups (A to G) in descending order of length. There are two sex chromosomes which are lettered XX in the normal female and XY in the normal male. Table 1 illustrates the chromosomes in each of the seven groups.

Study the chromosomes types that are illustrated in Table 1 and also observe the normal male karyotype shown in Figure 2. How would a normal female differ from the karyotype shown in Figure 2?

INVESTIGATION:

You will prepare three karyotypes from copies of three different metaphase plates and from these you should be able to identity the condition and chromosomal makeup of each karyotype.

PROCEDURE

1. Take one of the three Metaphase Plates which you have received and unsnap all the pieces carefully.

2. Using the information from Table 1, and using Figure 2 as a model, arrange the similar chromosome pairs in the proper location in the Chromosome Holder.

3. Once you have completed the karyotype, refer to the information in Table 2 to help you in the identification of the condition present in a person with this type of cell.

4. Place all of the pieces from this completed Metaphase Plate in a labeled plastic bag.

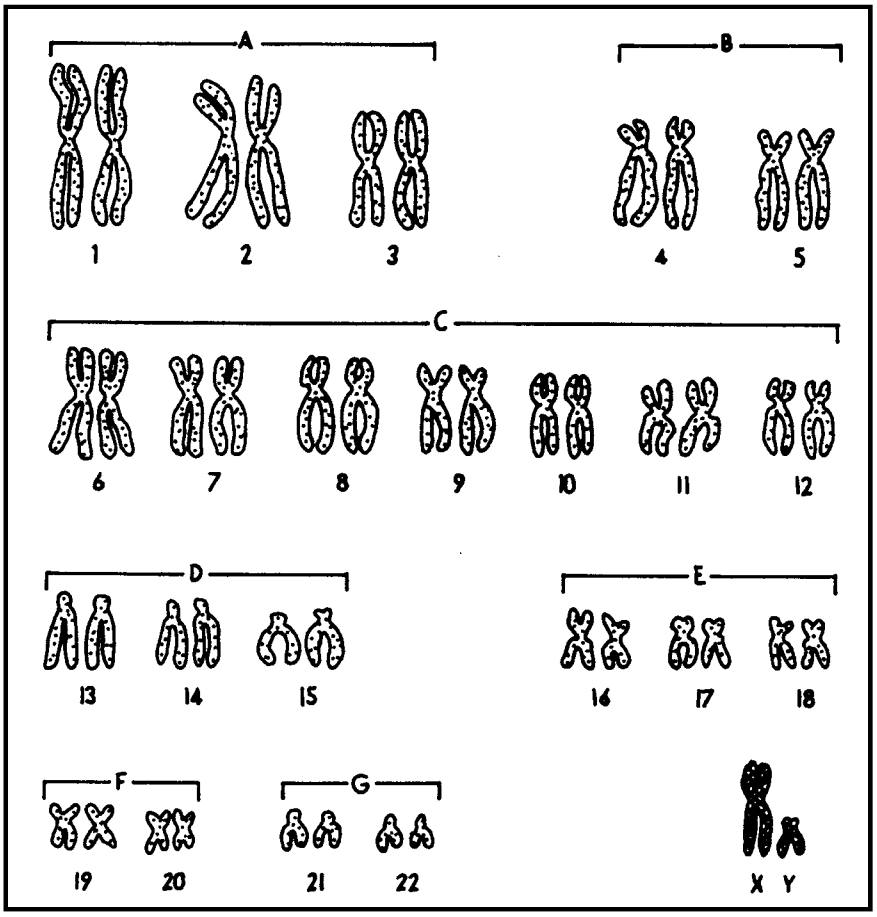


Figure 2 Karyotype of normal male.

5.Repeat the above steps for each of the remaining Metaphase Plates.

QUESTIONS TO CONSIDER AND DISCUSS:

What condition is exhibited by Metaphase Plate 1? and Why? What condition is exhibited by Metaphase Plate 2? and Why? What condition is exhibited by Metaphase Plate 3? and Why?

What has to happen during meiosis to cause each of the following disorders?

Down's Syndrome
KIeinfelter's Syndrome
Turner's Syndrome

Do your answers agree with your classmates? In what way(s) do your answers disagree? What are some of the problems that you had in working with the Metaphase Plates?

Table 1.

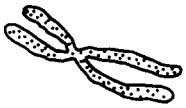
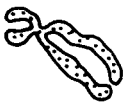
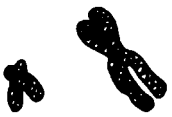
Group A Chromosome 1, 2, 3 Very long arms with median centromeres	
Group B Chromosome 4, 5 Long with submedian centromeres	
Group C Chromosome 6 - 12 Medium with submedian centromeres	
Group D Chromosome 13, 14, 15 Medium, centromeres near terminal end	
Group E Chromosome 16, 17, 18 Short, 16 median, 17, 18, submedian	
Group F Chromosome 19, 20 Shorter than E, submedian centromeres	
Group G Chromosome 21, 22 Very short, wishbone	
XX, XY Sex chromosomes (note darkened drawings)	

Table 2.

Chromosome Finding:	Condition:
22 autosomal pairs plus Xx	Normal female
22 autosomal pairs plus xY	Normal male
23 pairs plus extra Group G chromosome	Down's Syndrome (Mongolism) 47 chromosomes
23 Pairs plus extra X chromosome	Klinefelter's Syndrome (XXY male)
22 autosomal pairs with only one X chromosome, no Y chromosome	Turner's Syndrome (XO female)

Time Allocation:

To prepare this product for an experimental trial should take less than ten minutes. Actual experiments will vary with needs of students and the method of instruction. One or two class periods will be required to complete this investigation.

Feedback:

If you have a question, a comment, or a suggestion that would improve this product, you may call our toll free number.