Creating a Karyotype: A Chromosome Study

An examination of the chromosomes of a cell under high magnification can give a lot of information about an organism. If the cells are from an unborn human, its sex can be determined before it is born. It can also be determined if the unborn may have certain birth defects or problems caused by improper chromosome numbers in its cells.

To prepare a "real" karyotype, cells from a human are "frozen" in metaphase of mitosis. These cells are broken open so that the chromosomes can be removed. The "metaphase spread" produced by a single cell is then photographed. The photograph can be cut apart and homologous chromosomes arranged in pairs according to size, location of the centromeres, and the length of the chromosome arms. Chromosome pairs are arranged in a specific order and labeled. The result is a karyotype.

Objectives: In this investigation you will
- learn what a karyotype is;
- prepare a karyotype of a human's chromosomes;
- analyze the karyotype to determine sex and the possibility of birth defects.

Materials:
- scissors
- tape or glue stick
- 1 page of chromosomes
- white paper

Pre-Lab Questions:
- Summarize how a karyotype is made in 5 major steps.

Procedure:
1. The figure on the back of this page is a representation of G-banded chromosomes (only 1 chromosome from each chromosome pair is represented).
2. Cut out the chromosomes from the chromosome "spread" and match them to the chromosomes shown on this page to identify the correct chromosome number. Match them using size, length of the arms, and the location of the centromere.
3. Match homologous pairs together and then tape them down on the blank piece of white paper in the correct order. Be sure to number each pair.
4. Note that the "X" chromosome has a single thick band on its upper end and four bands on its lower end. The "Y" chromosome is very small and has a single thick band on the tips of its arms at one end.

Discussion Questions:
1. How many chromosomes are present in this karyotype?
2. How many chromosomes are present in each cell of this human (not including sex cells)?
3. What is the diploid chromosome number for your karyotype?
4. What is the haploid chromosome number for your karyotype (your karyotype may have 2 answers here)?
5. Which sex chromosomes are present in the karyotype you prepared?
6. What sex will this unborn child be?
7. a) According to this karyotype, will this unborn child have a genetic disease or condition?
   b) If so, what will it have?
8. When karyotyping, what 2 major pieces of information can be gained about a child before it's born?
Figure 10A-2  Diagram of G-banded chromosomes.
Answers- Creating a Karyotype: A Chromosome Study

Answers to Pre-Lab Questions:
1. _____________________________________________________________________________________
2. _____________________________________________________________________________________
3. _____________________________________________________________________________________
4. _____________________________________________________________________________________
5. _____________________________________________________________________________________

Discussion Questions:
1. ________________________   2. ________________________
3. ________________________   4. ________________________
5. ________________________   6. ________________________
7a. ________________________   7b. ________________________
8. ____________________________________________________________________________________

Answers- Creating a Karyotype: A Chromosome Study

Answers to Pre-Lab Questions:
1. _____________________________________________________________________________________
2. _____________________________________________________________________________________
3. _____________________________________________________________________________________
4. _____________________________________________________________________________________
5. _____________________________________________________________________________________

Discussion Questions:
1. ________________________   2. ________________________
3. ________________________   4. ________________________
5. ________________________   6. ________________________
7a. ________________________   7b. ________________________
8. ____________________________________________________________________________________
TEACHER ANSWERS TO KARYOTYPE:

#1: Normal Male
#2: Down Syndrome Female
#3: Normal Female
#4: Klinefelter's Male