

Born of Blood: Chromosome Chronicles

Student Information Page 3C - Part 2

Activity Introduction:

Every one has heard something about “designer genes”, “chromosome mapping”, or the “Human Genome” – it’s an exciting time for everyone involved in the field of genetics. For the past decade, a worldwide, cooperative study called the *Human Genome Project* has been underway to identify all of the human genes and to map them on specific chromosomes. In this activity, you will have the chance to see some of what has been happening!

Activity Background:

The traits you have are determined by the genes in the chromosomes you inherit from your parents. A *gene* is a specific place on a chromosome that determines a trait (characteristic). Every trait is controlled by *at least* one gene from Mom and *at least* one gene from Dad, thus it takes *at least one gene pair* to control a trait. Some traits are controlled by only one gene pair (*monogenic*) and other traits are controlled by more than one gene pair (*polygenic*). For example, having hair on your hands is a trait controlled by a single gene pair. Eye color is a trait controlled by three gene pairs. ABO blood type is controlled by at least two gene pairs.

Centromere position and *banding pattern* on chromosomes are specific to individual chromosomes and can be used to distinguish one chromosome from another. Each chromosome is divided into two parts by the *centromere*, shown in red on each chromosome model. The short part of the chromosome is called the *p Arm* and the long arm is called the *q Arm*. Each band on a chromosome is numbered and thus provided a location

marker geneticists use to map *genes* along a chromosome. Diagrams of each chromosome with numbered bands are called ideograms, see *Figure 1* on the following page. The yellow bands represent areas of variable staining, the blue-green areas represent areas of little gene activity, and purple areas represent very active areas of the chromosome.

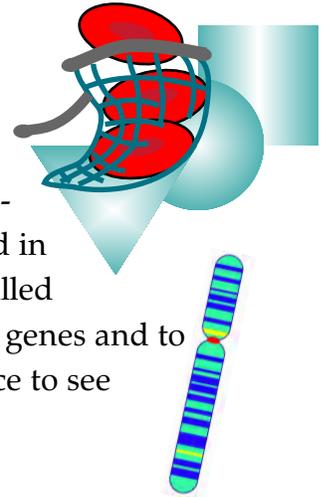
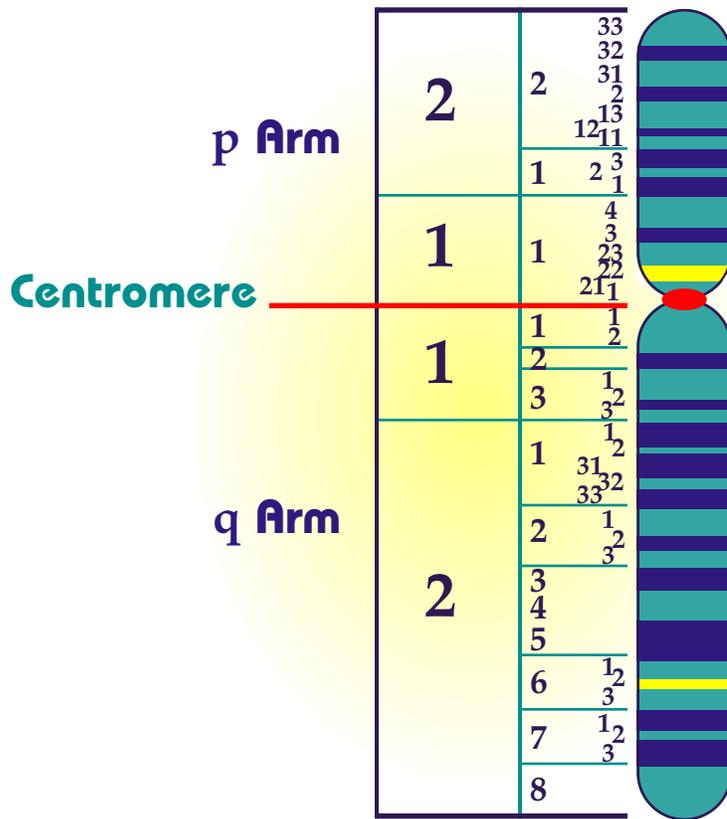


Figure 1 Chromosome X Ideogram



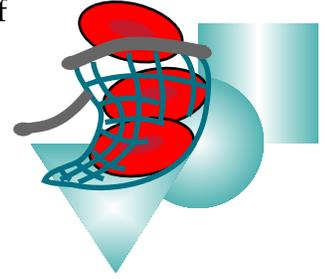
Each chromosome in our body has information to control thousands of traits. This information is located in very specific locations along the chromosome. These specific locations on a chromosome that control a specific trait are called genes. Thanks to the *Human Genome Project*, we can map these genes along the chromosome. By observing *Figure 1* above, you can see that each chromosome is divided into two parts by the centromere. The first part is the shorter arm, called the *p Arm*. The second part is the longer arms, called the *q Arm*. Each part of the chromosome has a unique banding pattern. These bands are numbered and gene locations defined by their location relative to the bands in the chromosomes. For example, a gene location of *XQ2.2* would be located in the *Q Arm, section 2, subsection 2 on the chromosome*. Students will be given some gene locations taken from the *Human Genome Data* and will locate them on their paper *Chromosome Patterns*. There is still wide discussion about the precise location of many genes, so this information has been extracted for instructional purposes only and not to be relied upon for any other reason.

Activity Materials: (per group of 2)

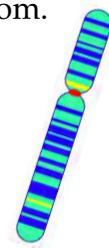
- 1 copy of *Student Information Page*
- 1 copy of *Chromosome Pattern Page* for each student in group
- 1 Metric ruler per student
- Scissors
- Colored markers
- Butcher Paper, Craft Foam, Foam Flotation Noodles or other materials for making the large chromosome models



Activity Instructions: Read the following instructions and check off each as it is completed.



1. Carefully read the background information for this activity.
2. Next, check yourself to be sure you remember the various parts of a chromosome by labeling the diagram on your *Chromosome Pattern Page*.
3. You will draw a number 1-22, X, or Y from your teacher. The number you draw will be the chromosome number you will be working on with your partner.
4. Label the parts of a chromosome on your *Chromosome Pattern Page*. Be sure to include the *Centromere, p Arm, q Arm, Active bands, Inactive bands,* and the *Variable bands*.
5. Map the genes listed on your *Chromosome Pattern Page*. For example if you are working on chromosome, 2, and are mapping the gene for webbed digits, you will see it is at location 2q34-36.
 - a. The “2” means chromosome 2.
 - b. The “q” refers to the q Arm of the chromosome.
 - c. 34-36 refers to the band location numbered 34-36.
 - d. Find that location and label the gene.
6. Using the Internet, go the *Online Mendelian Inheritance in Man* website: <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=search&DB=omim> You will see a search feature at the top of the page. Type in your chromosome number, for example, Chromosome 2, and a listing of genes will appear. Choose 6 additional genes and write what they do and their location in the *Table 1 Other Genes Found* on your *Chromosome Pattern Page*.
7. Use your *Chromosome Pattern Page* to plan your model. Your model must be:
 - a. 10 times the size of your paper model in all directions.
 - b. Three dimensional.
 - c. Labeled with specific genes found on the chromosome.
 - d. Colored and labeled to show the p Arm, q Arm, centromere, variable regions, active regions and less active regions.
 - e. An artistic or graphical representation of each gene on the chromosome.
 - f. Able to hang on the wall or from the ceiling.
8. Make your chromosome model so it can be added to all the other chromosomes to make a huge *Human Karyotype* in your classroom.



LESSON 3
ACTIVITY 3C-2