

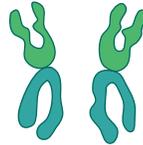
Born of Blood: Chromosome Chronicles

Activity 3C - Part 2

Activity Objectives:

Using paper chromosomes, students will be able to:

- ◆ Identify the parts of a chromosome
- ◆ Locate specific genes on human chromosomes
- ◆ Demonstrate how traits are encoded in genes found on chromosomes



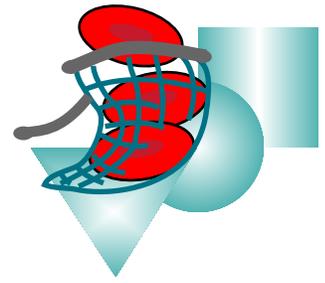
Activity Description:

Working in pairs, students will select a human chromosome and map a few selected genes onto a paper representation of their chromosome. Next, they will use an online database from the *Human Genome Project* to identify and map 6 additional genes. As a culminating activity, they will create a chromosome model that is exactly 10 times larger than their paper model. The classroom will morph into a huge nucleus from a human cell as the giant chromosomes are placed around the room.

Activity Background:

The traits we have are determined by the genes in the chromosomes we inherit from our 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.



Activity Overview

CAST YOUR NET: ADVENTURES WITH BLOOD



LESSON 3
ACTIVITY 3C-2

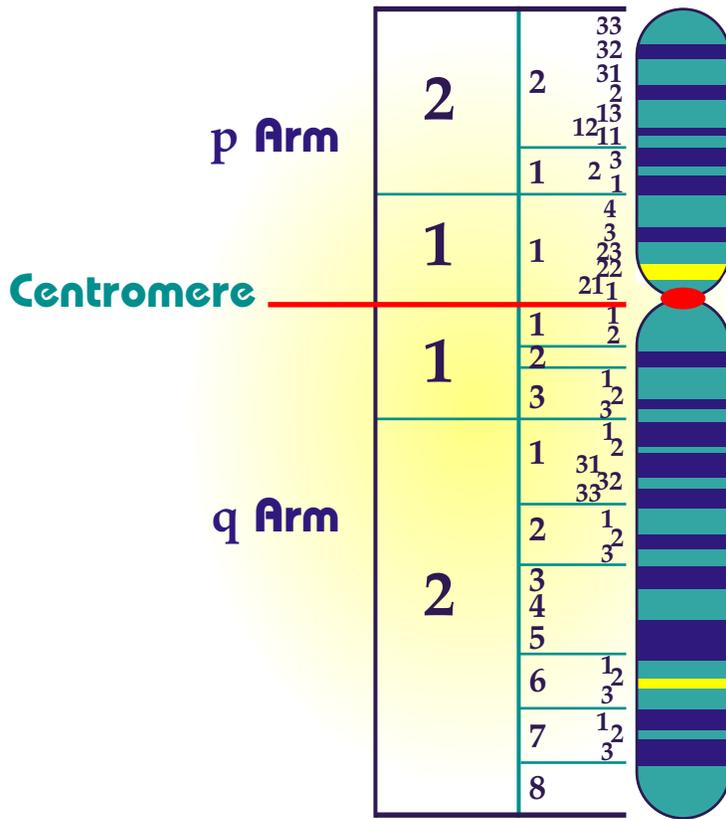
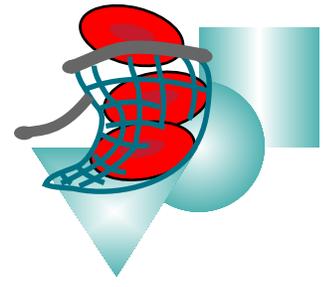
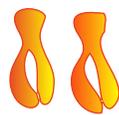


Figure 1 Chromosome X Ideogram

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 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 divide 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 a *Human Genome Database* 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 Overview Continued

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LESSON 3
ACTIVITY 3C-2

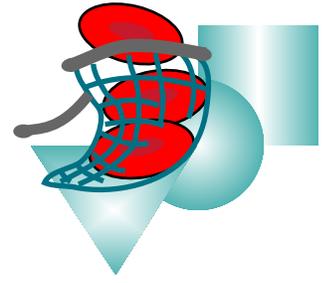
Activity Materials: (per group of 2)

- 1 copy of *Student Information Page*
- Sets of *Chromosome Patterns* as needed so each pair of students gets 1 chromosome*
- 1 Metric ruler per student
- Scissors
- Colored markers
- Butcher Paper, Craft Foam, Foam Flotation Noodles, Papier mache, or other materials for making the large chromosome models

* For example, if you have 150 students, you will have 75 student pairs working on the activity. Divide the number of student pairs by 24 chromosomes per set and round to the highest number, so you will need 3 sets of chromosomes for all of your classes.

Activity Management Suggestions:

1. Review group skills with students
2. Review basic definitions of genes and chromosomes
3. Allow students to work in pairs for this activity. Write numbers 1- 22, X and Y on small pieces of paper and allow student pairs to draw a number for their chromosome. Alternately, you can assign a chromosome number to students.
4. When the large chromosome models are turned in, hang them from the ceiling of the classroom to turn the classroom into a giant human nucleus. Be sure to hang complete sets of 46 chromosomes together! Have students determine whether the “cell” belongs to a male or female
5. Unlike other activities, there will be no *Student Data Page* section in this activity. Students will record all information on the *Chromosome Pattern Pages* that follow this teacher section.



Activity Overview Continued

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LESSON 3
ACTIVITY 3C-2

Activity References Used:

Online Mendelian Inheritance in Man website:

<http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?CMD=search&DB=omim>

GENOME...the autobiography of a species in 23 chapters website

http://flysci.com/genome/genome_9.asp

The Human Genome Project at Sanger Centre at the Wellcome Trust
Genome Campus

http://www.wellcome.ac.uk/doc_WTD002945.html

Chromosomes and Genetic Mapping

<http://www.woodrow.org/teachers/bi/1994/chromosomes.html>

Human Genome Project

http://www.ornl.gov/sci/techresources/Human_Genome/home.shtml

National Institutes of Health

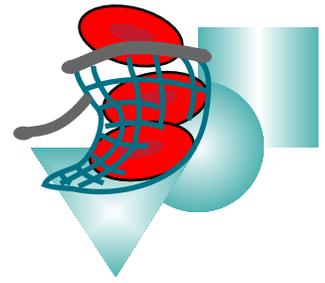
<http://www.ncbi.nlm.nih.gov/>

National Institutes of Health, Bethesda MD 20894, USA.

<http://www.ncbi.nlm.nih.gov/SCIENCE96/chr.cgi?9>

Genome News Network Website

http://www.genomenewsnetwork.org/resources/whats_a_genome/Chp1_1_1.shtml#genome1



Activity Overview Continued

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