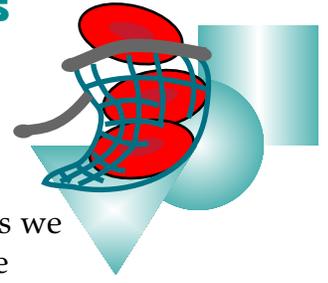


# Born of Blood: Craft Stick Chromosomes

## Student Information Page 3C - Part 1

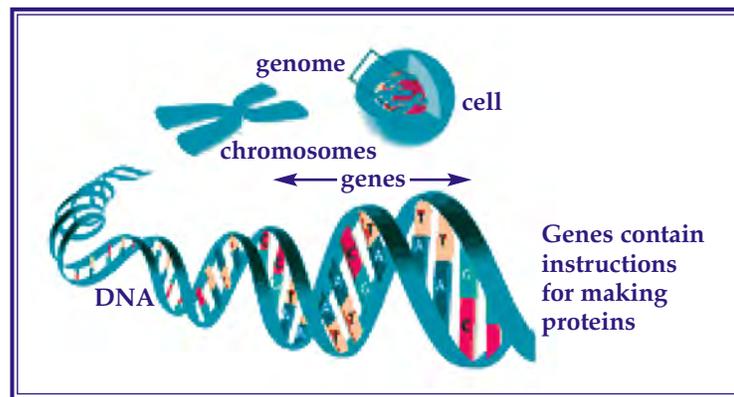
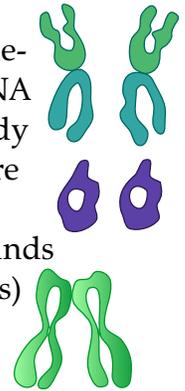


### Activity Introduction:

Activity Introduction: Look around at others in your class – it doesn't take long to realize that everyone is unique. This is because of the different genes we inherit from our parents. Because of a worldwide scientific project called the Human Genome Project, we now have detailed information about the genes that control specific traits and even where those genes are located on our chromosomes. In this activity, you will make *Craft Stick Chromosomes* and use them to create a model of a human *karyotype*.

### Activity Background:

We are complex beings made up of thousands of characteristics (*traits*). The “blueprint” for all of these traits is in our chromosomes. *Chromosomes* are made of DNA (deoxyribonucleic acid) and proteins. They are found in the nucleus of every body cell, except red blood cells. Red blood cells do not contain a nucleus and therefore do not contain the chromosomes found in body cells with a nucleus. We have a total of 24 *different* chromosomes, each with information for hundreds or thousands of traits. Each kind of human chromosome is numbered 1 through 22 (autosomes) plus a unique pair of sex chromosomes called X and Y. We inherit one of each kind of autosome from our mother and one of each kind from our father. We also inherit either an X or a Y from our fathers (males have 1 X and 1 Y chromosome) and one X chromosome from our mothers (females have 2 X chromosomes). This means we end up with 23 *pairs* of chromosomes, for a total of 46.



**Figure 1 Chromosomes and Genes**

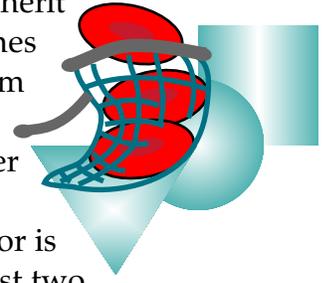
image credit: U.S. Department of Energy Human Genome Program, <http://www.ornl.gov/hgmis>

Chromosomes are usually found in long, twisted strands in the nucleus, much like spaghetti twisted in a bowl. When a cell is ready to divide, the chromosomes become shorter and thicker and make copies of themselves. The two copies are held together at the center (*centromere*), which gives them the appearance of an “X” – at this point, they are visible under a light microscope. When a cell divides, each daughter cell gets one copy of every chromosome, or a full set of 46.



**LESSON 3**  
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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



### Activity Materials: (per group)

- 1 copy of *Student Information Page* per group
- 1 copy of *Student Data Page* per student
- 1 set of *Chromosome Patterns* per group
- 24 slim craft sticks in assorted colors per group of 4
- 1 Metric ruler per student
- Scissors
- Colored markers
- Glue Sticks



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

1. Look at the *Chromosome Patterns* given to your group.. You will use these patterns to make *Craft Stick Chromosome* models of the 24 types of human chromosomes (22 autosomes and two kinds of sex chromosomes, X and Y).
2. First, assign every person in your group of four students 6 chromosomes from the *Chromosome Patterns* page.
3. Use a marker to color the *centromere* region of each *Chromosome Pattern* red. This is the pinched area of the chromosome that separates the P Arm from the Q Arm. There are no known genes in this area.
4. Use a marker to color the *striped regions* of the *Chromosome Patterns* yellow. These areas of the chromosome are variable in the way they take stain and therefore appear differently from other areas of the chromosome.
5. Use a marker to color the *white regions* of the *Chromosome Patterns* blue. These are more active areas of the chromosome.
6. Use a marker to color the dotted regions of the *Chromosome Patterns* purple. These are areas where protein binds tightly to the chromosome and there is much less activity in these locations.
7. Next, cut out each of the *Chromosome Patterns* you colored and glue them to the craft sticks.



LESSON 3  
ACTIVITY 3C

8. When your group has completed all 24 chromosomes according to the instructions, put them all in the center of the table. *Decide if you will use the X or the Y chromosome and remove the one not chosen from your set of chromosomes.* Now, each person in the group will randomly pick six chromosomes from the pile. (The last person to choose their chromosome models will receive only 5).
9. You will work with another group as assigned by your teacher.
10. Your job is to take your six *Craft Stick Chromosomes* and find the “matching” chromosomes from the other group.
11. Place your matched chromosomes on the table. Using the *Chromosome Key Pages*, arrange the matched chromosomes in order by chromosome number. Look at *Figure 2 Human Karyotype* below.
12. Your *Karyotype* represents the *46 chromosomes* (23 pair) found in the nucleus of every body cell, with the exception of red blood cells and egg and sperm cells.



**Figure 2 Human Karyotype**

