

# FORMS OF TRAITS

## OBJECTIVE:

In this lab you will discover some basic concepts of human genetics. You will observe both autosomal and sex linked trait transmissions, in this lab

## INTRODUCTION:

**Genetics** is concerned with the mechanisms whereby traits are passed from parent to offspring. These genes code for a **genotype** which code for a specific **trait**. An **allele** is the alternate form of trait found on the same gene **loci**. A **phenotype** is the trait that you can observe. For example, a person's phenotype would be hair color or any observable trait. The genotype are the genes that code for the phenotype. Some genes are **dominant**, meaning that the gene is expressed in all offspring carrying that gene. Other genes are **recessive**, where you carry the gene but it is not expressed. **Homozygous** genes are two of the same gene (GG or gg). **Heterozygous** genes are two different genes (Gg).

This lab is divided into two parts. The first deals with **autosomal** traits. The second part reviews **sex linked** traits.

## PART ONE OBSERVATIONS:

The following are autosomal traits which are caused by a single gene.

### PTC Tasting

Phenylthiocarbamide (PTC) is a non toxic chemical that some individuals can taste. The ability to taste this bitter chemical is inherited through a dominant gene. If you can not taste or are a non taster, you carry the recessive genes. Lets assign the letter "T" for the tasting trait and "t" for the recessive non tasting gene. If you can taste the PTC you carry the dominant gene T. If you can not taste you have inherited the homozygous recessive trait "tt".

Take a small piece of control paper. This paper is not treated with any of the PTC chemical. Chew it and mark any observations below. Then place the chewed paper in the bin marked biologicals/body fluids.

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Take a small piece of PTC paper. This paper is treated with the PTC chemical. Chew it and mark any observations below. Then place the chewed paper in the bin marked biologicals/body fluids.

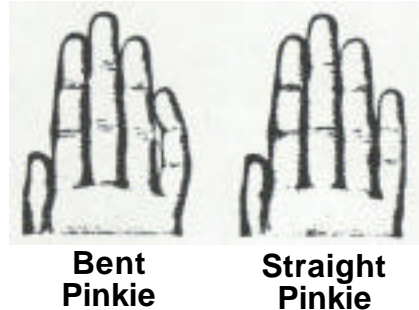
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What is your genotype for this trait? \_\_\_\_\_

### **Bent Little Finger**

Lay your hands flat on the table and relax them. Does the last joint of your little finger bends toward the forth finger (see the diagram below)? If you have the bent pinkie finger you have the dominant allele "B". If the fingers are straight and extend parallel to each other out to the very tip, you carry the recessive allele "b".



What is your genotype for this trait? \_\_\_\_\_

### **Pigmented Iris**

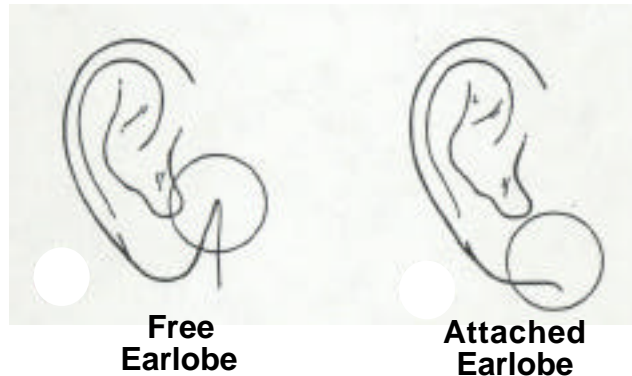
If you are homozygous for the recessive allele "p", you do not produce pigment in the front layer of your iris. If you have no pigment you have either blue or gray eyes. The "P" allele produces the pigment which gives you eye color. Eye colors are green, hazel, brown or black.

What is your genotype for this trait? \_\_\_\_\_

What is your phenotype? \_\_\_\_\_

### **Attached Earlobes**

Some individuals have earlobes which are attached to the side of their head and others have free or unattached earlobes (see diagram below). The unattached or free earlobe trait is dominant over the attached lobe trait.

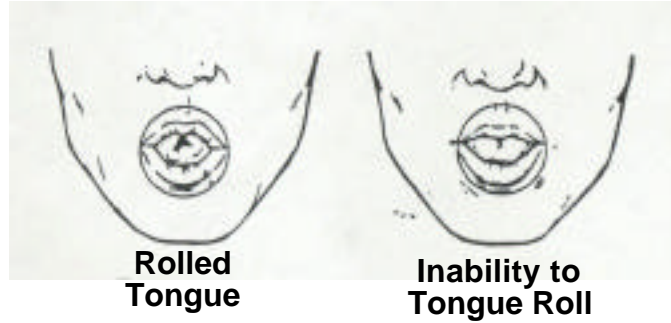


What is your genotype for this trait? \_\_\_\_\_

What is your phenotype ? \_\_\_\_\_

### **Tongue Rolling**

The ability to roll your tongue (see diagram below), is the result of a dominant gene. If you cannot roll your tongue you carry the recessive trait.



What is the tongue rolling genotype ? \_\_\_\_\_

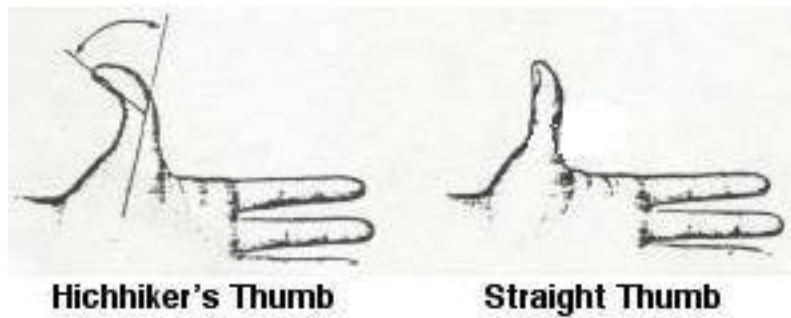
What is the non tongue rolling genotype ? \_\_\_\_\_

What is your phenotype ? \_\_\_\_\_

What is your genotype ? \_\_\_\_\_

### Hitchhiker's Thumb

Some individuals can bend the distal joint of the thumb back to nearly a 45° angle between the two joints of the thumb (see figure below). If you bend your thumb up or have distal hyperextensibility of the thumb you are homozygous for this trait.

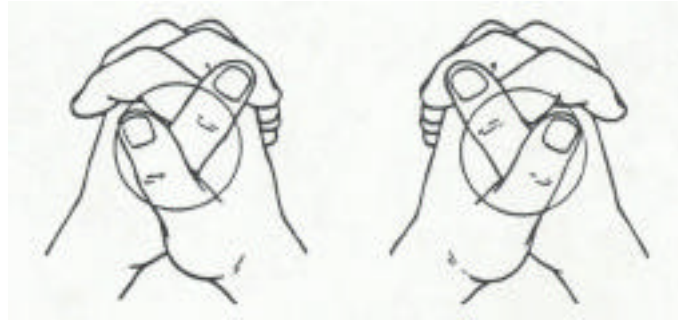


What is your phenotype ? \_\_\_\_\_

What is your genotype ? \_\_\_\_\_

### Hand Clasping or Interlacing Fingers

Casually fold your hands together so your fingers interlace (see figure below). If when you clasp your hands and you observe that your right thumb is over the left you carry the dominant form of the trait.



Right Thumb Over  
The Left Thumb

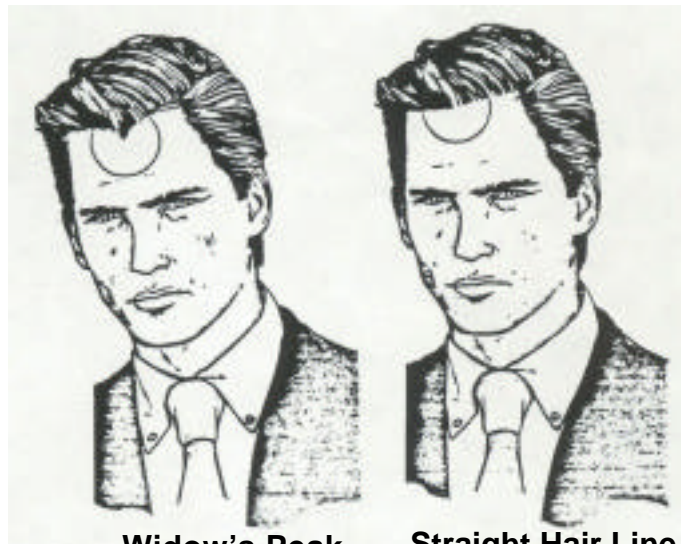
Left Thumb Over  
The Right Thumb

What is your phenotype ? \_\_\_\_\_

What is your genotype ? \_\_\_\_\_

**Widows Peak**

Some individuals have a hair line which dips to a slight “V shape” in the middle of their forehead (see diagram below) If you have a widow’s peak you inherited the dominant trait.



**Widow’s Peak**

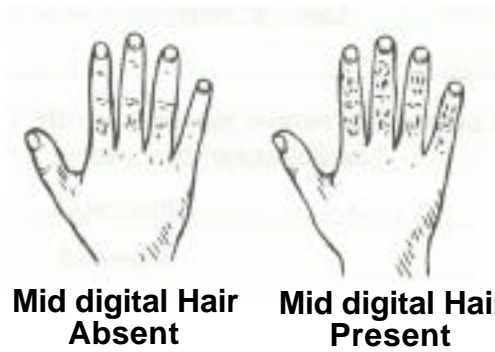
**Straight Hair Line**

What is your phenotype ? \_\_\_\_\_

What is your genotype ? \_\_\_\_\_

**Mid Digital Hair**

The allele for hair on the middle segment of your fingers is dominant to the allele for no mid digital hair (see diagram below). Look in the area between your nail and the mid joint, see if you have any hair in the mid digit area. If you have hair you have the dominant gene.



What is your phenotype ? \_\_\_\_\_

What is your genotype ? \_\_\_\_\_

**PART ONE  
DATA COLLECTION:**

Collect the data that you generated by looking at your traits. Then collect the data that your classmates observed. Use this table to generate class percentages for each trait.

Table 1

Trait Observed	Dominate Genotype	Number Of Students In Class	Frequency Of Trait Expression	Frequency Of No Trait Expression	Percent Trait Carriers
PTC Tasting					
Bent Little Finger					
Pigmented Iris					
Attached Earlobes					
Tongue Rolling					
Hitchhiker Thumb					
Hand clasping					
Widow's Peak					
Mid digit Hair					

## PART TWO OBSERVATIONS:

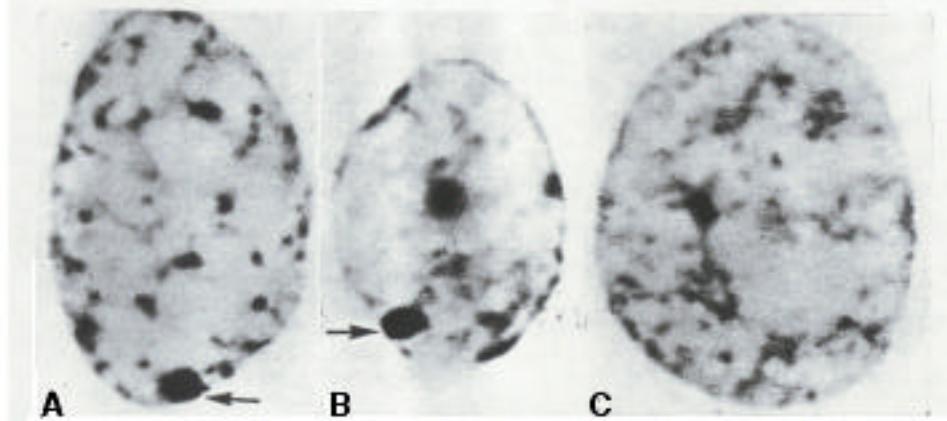
The following are **sex linked traits** which are caused by a single gene.

Sex determination is encoded in the **X** and **Y** genes. There are genetic diseases and certain characteristics that are associated with the **sex chromosomes**.

### Barr Bodies

In 1948, before the discoveries of Lyon, Barr and Bertram found that in the interphase nucleus of female cat neurons there were a significant number of cells that had one "darkly staining body" lying along the edge of the nucleus. They never found a "darkly staining body" in the neurons of male cats. Similar "darkly staining bodies" are found in buccal epithelial cells of human females, although they can usually be found in only 30% to 40% of the cells.

Normal males never express these "**Barr bodies**." In all cases, the number of Barr bodies is one less than the number of X chromosomes in an individual. One Barr body means the individual has two X chromosomes, two Barr bodies means the individual has three X chromosomes, etc. We now know that the "darkly staining" Barr body is the condensed, inactive X chromosome. The **inactive X** usually lies along the edge of the interphase nucleus in a highly condensed state. It is always the last to replicate. Take a look at the slide below for an example of a Barr body.



A and B are the nuclei obtained from a female. Notice the dark stained area in the lower portion of the nucleus of A and B, this is the Barr body. The nuclei C is from a male and has no Barr body.

### Color Blindness

Red green color blindness is transmitted through the sex chromosomes. Below is a test to determine if you have the symptoms of color blindness. Remember this is only a test, and you can only be "officially" diagnosed by a medical doctor.

The test consists of 19 plates which are color coded. Individuals can observe different degrees of color. These variations can indicate if a person has difficulties in color perception.

Use the test chart so you can record the numbers that you observe from the test plates. In the back of the book of test plates there is a answer or score sheet where you can check your answers.

## Test Chart

1		11	
2		12	
3		13	
4		14	
5		15	
6		16	
7		17	
8		18	
9		19	
10			

### Hemophilia

Hemophilia is a **X linked inherited** disease which effects one in 10,000 males. In X linked inheritance a male always receives a sex linked condition from his mother, from whom he inherited the X chromosome. Let us assume a non effected male mates with a female carrier. If the offspring is a male he has a 50% chance of being effected with the trait. If the offspring is a female she has a 50% chance of being a carrier.

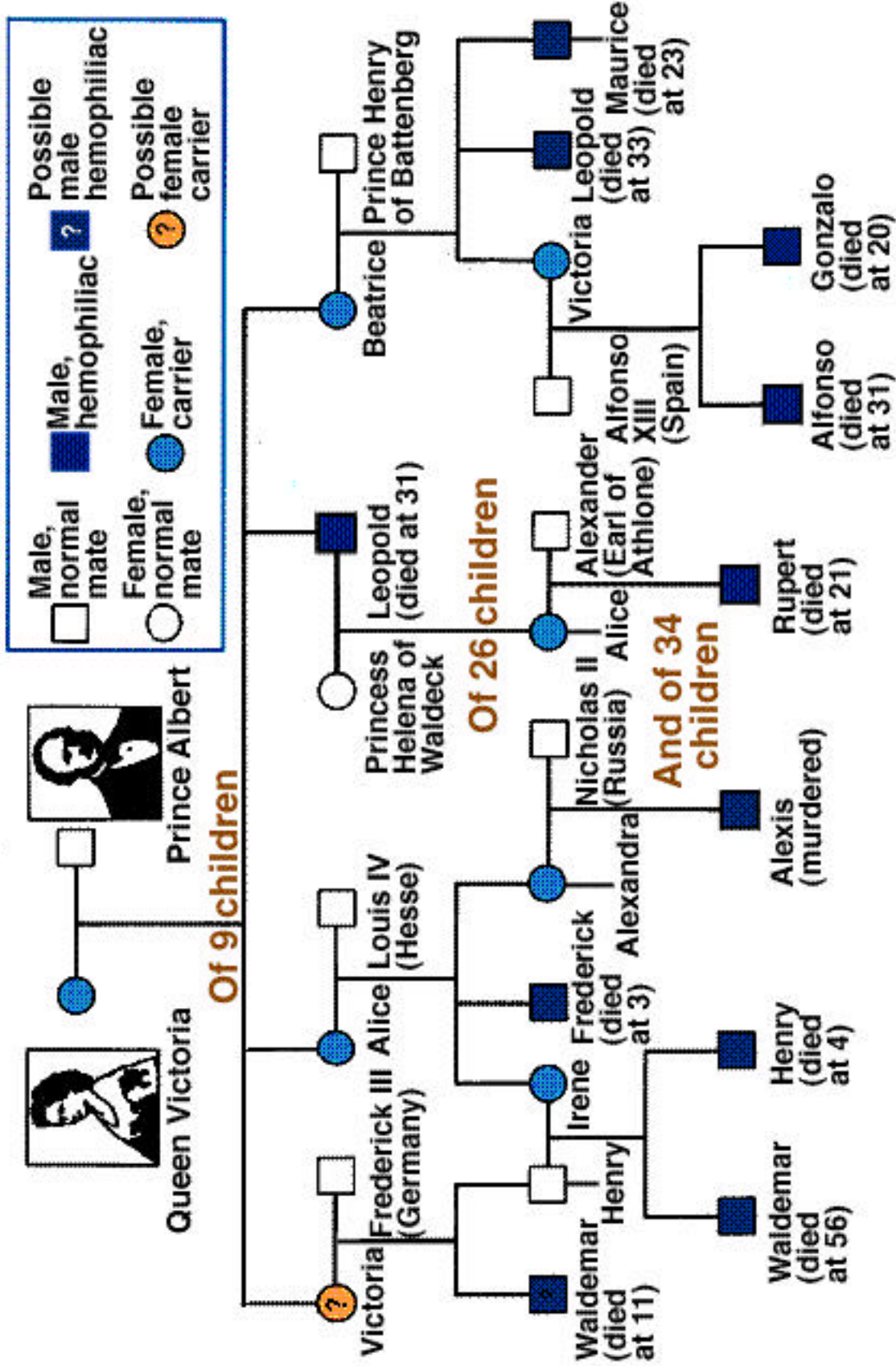
The classic study of the European royal families is best used to describe the transmittance of the X linked disease. A **pedigree** is a chart which shows the pattern of inheritance for a particular condition by mapping the matings and their offspring. A pedigree is like a family tree that maps out a disease state.

Attached you will find a simplified pedigree that represents the European royal families. This chart will help you to visualize the passing of this X linked trait and to answer the questions below. Remember that this pedigree only represents the crossings that produced individuals that carry the X linked trait. There are no hemophiliacs in the present British royal family because Victoria's eldest son, King Edward VII, did not receive the gene and therefore could not pass it on to any of his descendants.

How many sons did Queen Victoria and Prince Albert have that were effected? \_\_\_\_\_

How many females did Alice and Louis IV produce that were carriers? \_\_\_\_\_

# Hemophilia Pedigree





# Laboratory Questions

Student\_\_\_\_\_

Section\_\_\_\_\_

Date\_\_\_\_\_

- 1) How does a geneticist define “dominance”?
  
  
  
  
  
  
  
  
  
  
- 2) When you toss a coin what is the probability that the coin will land with the head side up?
  
  
  
  
  
  
  
  
  
  
- 3) Why was a control used when performing the PTC experiment?
  
  
  
  
  
  
  
  
  
  
- 4) Reviewing the data of the class from the data chart, was the dominant form of a trait always the frequent form? If so what trait was it?
  
  
  
  
  
  
  
  
  
  
- 5) Explain the difference between sex linkage and autosomal linkage.

6) If a male is color blind, he inherited the allele for color blindness from which parent?

7) If a female is XXY (Klinefelters Syndrome) how many Barr bodies will you see in here nucleus?

8) What did you find most interesting about this lab?