Mendelian Genetics in Humans

Part I: Monohybrid Crosses in Humans

Several human traits may be used to demonstrate Mendel's law of segregation. The traits you will study are controlled by a single gene that can occur in two forms (alleles). One allele is dominant, the other is recessive. A person's phenotype is determined by the combination of alleles present. An individual can be homozygous dominant, heterozygous, or homozygous recessive.

Objectives

Describe the genetic basis for several human traits evidence in the classroom population. Determine the extent to which individuals are different from one another based on the presence or absence of selected genetic traits.

Procedure

For each of the following 11 traits, determine your phenotype and enter it in the table. Based on your phenotype, record your possible genotypes for each of the traits. Remember that if you have a recessive characteristic you must have both recessive alleles, but if you hae a dominant characteristic you may be either homozygous dominant or heterozygous. If you have a dominant phenotype, you may have no way of knowing whether you carry a recessive allele. In this case, use a dash (--) to represent the unknown second gene.

With the help of your teacher, compile the data for your class. Calculate percentages for each trait. Graph the percentages for each trait.

1. **Dimpled Chin**: a cleft in the chin is a dominant trait. (D = allele for dimpling, d= allele for absence of a dimple).
2. **Free Ear Lobe:** In most people the ear lobes hang free (dominant allele, E), but in a person with two recessive alleles (e), the ear lobes are attached directly to the head. Use a mirror/friend to determine your phenotype.
3. **Window's Peak:** The action of the dominant allele (W) results in a hairline that forms a distinct point, known as a widow's peak, in the center of the forehead. The recessive allele (w) produces a continuous hairline. Omit this category if a gene for baldness has had some effect on your hairline.
4. **Ability to Taste PTC**: Some persons detect a distinct bitter taste in mall concentrations of the chemical phenylthiocarbamide (PTC), while others do not taste it. A dominant allele, T, stands for the ability to taste this chemical; those who are homozygous for the recessive allele are non-tasters. Place a PTC paper strip on your tongue and allow it to remain there for about 10 seconds. If you are a taster, you will know it. IG you have any doubt about your ability to taste the substance, you are a non-taster. There are links to regions of the world for tasters and non-tasters. Tasters tend to dislike leafy greens.
5. **Interlocking Fingers:** When the fingers are interlocked, some people will almost invariably place the left thumb on top of the right (dominant allele F), whereas others will place the right over the left (recessive allele, f).
6. Bent Little Finger: A dominant allele B causes the last joint of the little finger to bend inwards towards the fourth finger (b is the recessive allele for a straight finger). Lay both hands flat on the table, relax your muscles, and note whether you have a bent or straight little finger.
7. **Hitchhiker's Thumb:** The characteristic, more precisely called distal hyperextensibility of the thumb, can be determined by bending the distal joint of variation, certain individuals can bend it back until there is almost a 90-degree angle between the joints. The characteristic is an effect of a recessive allele h (dominant allele, H).
8. **Long Palmar Muscle:** A person homozygous for a recessive allele, l, has a long palmar muscle that can be detected by examination of the tendons running over the inside of the wrists. Clench your fist tightly and flex your hand. Now feel for two tendons (the large middle one will be missing) if there are not two, you do not have this muscle. Examine both wrists – if you find this trait in one of both wrists, you have two recessive alleles. IF not, you have the dominant allele L.
9. **Pigmented Irises:** When a person is homozygous for the recessive allele p, there is no pigment in the front part of the eyes and a blue layer at the back of the iris shows through resulting in blue eyes. A dominant allele of this gene P, causes pigment to be deposited n the front layer of the iris, thus masking the blue to varying degrees.

Other genes determine the exact nature and density f this pigment, thus there are brown, hazel, violet, green, and other eye colors. Here you are concerned only with the presence or absence of such pigment.

10. **Mid-Digital Hair:** Some people have hair on the second (middle) joint of one or more of the fingers, while others do not. The complete absence of hair is due to a recessive allele, m, and the presence of hair is due to a dominant allele, M. There seems to be a number of alleles determining whether hair grows on one, two, three, or four fingers. This hair may be very fine, so you should use a hand lens to look carefully on all fingers before deciding whether this hair is present on any one of your fingers, indicating the presence of dominant allele, M.
11. **Second (Index) Finger Shorter than the Fourth:** This is a characteristic that appears to be sec-influences. Use the symbol S^S for a shorter second finger and the symbol S^L for a longer second finer. Tabulate your results by biological sex, since the frequency should very by biological sex.

Table: Genetic Traits **Name:_____**

			Data for Your Laboratory Group	
Characteristic	Your Phenotype	Your Possible Genotypes	Number of Each Phenotype	Percentage
Dimpled chin (D) Nondimpled chin (d)				
Free ear lobes (E) Attached ear lobes (e)				
Widow's Peak (W) No widow's peak (w)				
Taster of PTC(T) Nontaster (t)				
Left thumb on top (F) Right thumb on top (f)				
Bent little finger (B) Finger not bent (b)				
Hitchhiker's thumb (h) Normal thumb (H)				
Long palmar muscle (l) Two tendons only (L)				
Pigmented iris (P) Unpigmented Iris (p)				
Mid-digital hair (M) No mid-digital hair (m)				
Shorter second finger (S^s) Longer second finger ($S^{L)}$				

Questions:

1. For the traits observed, did you find that the dominant or the recessive alleles were expressed most often in your lab group?

2. Which traits did not fit into this trend?

3. Explain why you think you got these results.

4. Why do you think different notations were used for the last trait, finger length? How could this connect to our genes?

5. Give an example of one genotype and phenotype from this lab.

Create a graph of your calculated percentages for each trait.

C.E.R.

Claim: Create a claim referencing your data that answers the following question: Are dominant traits always the most common traits that people have?

Evidence: What is the evidence (numbers only) that supports your claim?

Reasoning: Provide an explanation for why your evidence supports your claim and how it makes sense based on what you already know or have learned in class.