

The AMAZING

Variation

Workbook of SCIENCE

I am owned by:



| Activity | Mark |
|-------------------------------------|---------------------|
| Vocabulary | Complete/Incomplete |
| Inventory of my traits | Complete/Incomplete |
| Inventory of my traits (Data Table) | Complete/Incomplete |
| Inventory of traits (Graph) | Complete/Incomplete |

Variation Vocabulary Words

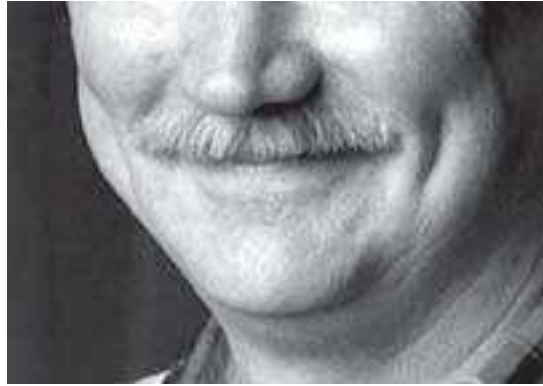
REMEMBER, science words must be spelled correctly!

| WORD | DEFINITION |
|--------------|------------|
| Gamete | |
| Gene | |
| Genome | |
| Chromosomes | |
| DNA | |
| Allele | |
| Phenotype | |
| Genotype | |
| Dominant | |
| Recessive | |
| Homozygous | |
| Heterozygous | |
| | |
| | |
| | |
| | |

EXAMPLES OF INHERITED TRAITS

Some people have a genetic trait that creates indentations on their cheeks called dimples

Dimples



These two images show the difference between a regular thumb and a "Hitchhiker's thumb" which, because of a genetic difference, can bend farther backwards.



Hitchhiker's Thumb



Regular Thumb

Tongue rolling is a genetic trait certain people have that allows them to curl their tongue.



Curled Tongue

Photo Credits: "The Amazing Picture Machine"

<http://www.ncrtec.org/picture.htm>

North Central Regional Technology in Education Consortium

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CAN YOU DO THIS WITH YOUR TONGUE? Try it!



Some people have toes that decrease (get smaller) in size from the big toe to the small one while other people have a second toe that is longer than their big toe.

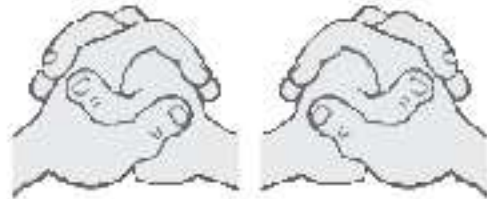


Short Second Toe



Long Second Toe

Are you right or left thumbbed? Put your hands together, interlocking your fingers. Which thumb is on top?



Left Thumbbed Right Thumbbed



Attached Earlobe



Unattached Earlobe

Are your earlobes attached or unattached? A person with attached ear lobes will have the lowest point of the ear lobe attached to the face. A person with unattached ear lobes will not have the lowest point of the ear lobe attached to the face.

Can you make a Vulcan hand sign like Mr. Spock does on "Star Trek"? Try to spread your fingers into a "v". Some people can do this easily and some people can't!



Vulcan



Earthling

Inherited Human Traits: A Quick Reference

Background Information

Physical traits are observable characteristics determined by specific segments of DNA called genes. Multiple genes are grouped together to form chromosomes, which reside in the nucleus of the cell. Every cell (except eggs and sperm) in an individual's body contains two copies of each gene. This is due to the fact that both mother and father contribute a copy at the time of conception. This original genetic material is copied each time a cell divides so that all cells contain the same DNA. Genes store the information needed for the cell to assemble proteins, which eventually yield specific physical traits.

Most genes have two or more variations, called alleles. For example, the gene for hairline shape has two alleles – widow's peak or straight. An individual may inherit two identical or two different alleles from their parents. When two different alleles are present they interact in specific ways. For the traits included in this activity, the alleles interact in what is called a dominant or a recessive manner. The traits due to dominant alleles are always observed, even when a recessive allele is present. Traits due to recessive alleles are only observed when two recessive alleles are present. For example, the allele for widow's peak is dominant and the allele for straight hairline is recessive.

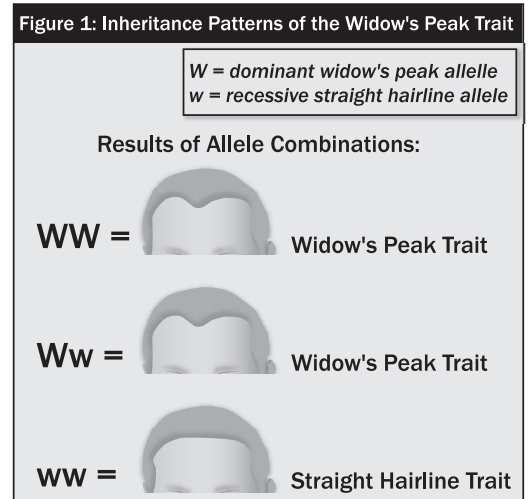
If an individual inherits:

- Two widow's peak alleles (both dominant), their hairline will have a peak
- One widow's peak allele (dominant) and one straight hairline allele (recessive), they will have a widow's peak
- Two straight hairline alleles (recessive), their hairline will be straight.

A widespread misconception is that traits due to dominant alleles are the most common in the population. While this is sometimes true, it is not always the case. For example, the allele for Huntington's Disease is dominant, while the allele for not developing this disorder is recessive. At most, only 1 in 20,000 people will get Huntington's; most people have two recessive, normal alleles.

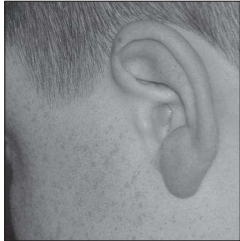
While a few traits are due to only one gene (and its alleles), most genetic traits are the product of interactions between several genes. When more than one gene influences a trait, the inheritance pattern is not easily predictable. The predictable patterns referred to as dominant and recessive apply only to single gene traits.

The traits listed on the next pages have commonly been presented as being determined by single genes. However, it is possible that some may involve more than one gene. When research studies have disagreed on the inheritance pattern for a trait, it has been noted below.



Inherited Human Traits: A Quick Reference

Earlobe Attachment



Attached Earlobes



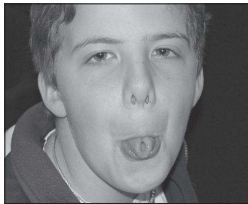
Detached Earlobes

If earlobes hang free, they are detached. If they attach directly to the side of the head, they are attached earlobes.

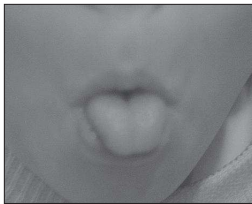
Some scientists have reported that this trait is due to a single gene for which unattached earlobes is dominant and attached earlobes is recessive. Other scientists have reported that this trait is probably due to several genes.

The size and appearance of the lobes are also inherited traits.

Tongue Rolling



Can Roll Tongue



Can't Roll Tongue

In 1940, the famous geneticist Alfred Sturtevant noted that about 70% of people of European ancestry are able to roll up the lateral edges of the tongue, while the remaining 30% were unable to do so.

Tongue rolling ability may be due to a single gene with the ability to roll the tongue a dominant trait and the lack of tongue rolling ability a recessive trait. However, there is some

question about the inheritance of tongue rolling. Recent studies have shown that around 30% of identical twins do not share the trait.

Cleft Chin

This trait is reportedly due to a single gene with a cleft chin dominant and a smooth chin recessive.

Dimples



Dimples are reportedly due to a single gene with dimples dominant (people may exhibit a dimple on only one side of the face) and a lack of dimples recessive.

Handedness

Some scientists have reported that handedness is due to a single gene with right handedness dominant and left handedness recessive. However, other scientists have reported that the interaction of two genes is responsible for this trait.

Inherited Human Traits: A Quick Reference

Freckles

This trait is reportedly due to a single gene; the presence of freckles is dominant, the absence of freckles is recessive¹.

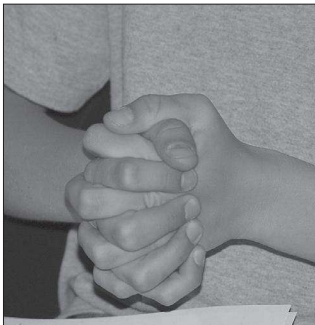
Naturally Curly Hair

Early geneticists reported that curly hair was dominant and straight hair was recessive. More recent studies suggest that more than one gene may be involved.

Allergies

While allergic reactions are induced by things a person comes in contact with, such as dust, particular foods, and pollen, the tendency to have allergies is inherited. If a parent has allergies, there is a one in four (25%) chance that their child will also have allergy problems. This risk increases if both parents have allergies².

Hand Clasping



Cross Left Thumb Over Right



Cross Right Thumb Over Left

Fold your hands together by interlocking your fingers without thinking about it. Which thumb is on top – your left or your right?

One study found that 55% of people place their left thumb on top, 45% place their right thumb on top and 1% have no preference.

A study of identical twins concluded that hand clasping has at least some genetic component. However, other scientists have not found evidence that genetics plays a significant role in determining this trait.

Colorblindness

Colorblindness is due to a recessive allele located on the X chromosome. Women have two X chromosomes, one of which usually carries the allele for normal color vision. Therefore, few women are colorblind. Men only have one X chromosome, so if they carry the allele for colorblindness, they will exhibit this trait. Thus, colorblindness is seen more frequently in men than in women.

¹ Rostand, J and T  try, A . *An Atlas of Human Genetics* (1964) Hutchinson Scientific & Technical, London.

² "All About Allergies", The Nemours Foundation (http://kidshealth.org/parent/medical/allergies/allergy_p2.h)

Inherited Human Traits: A Quick Reference

Hairline Shape



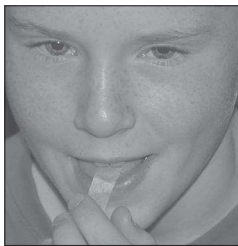
Widow's Peak Hairline



Straight Hairline

Hairline shape is reportedly due to a single gene with a widow's peak dominant and a straight hairline recessive.

PTC Tasting



Does Not Taste PTC



Tastes PTC

For some people the chemical PTC (phenylthiocarbamide) tastes very bitter. For others, it is tasteless.

The ability to taste PTC shows dominant inheritance and is controlled by a gene on chromosome 7. This gene codes for part of the bitter taste receptor in tongue cells. One of its five alleles (forms) causes a lack of ability to sense bitter tastes; the other four alleles produce intermediate to fully sensitive taste abilities. Approximately 75% of people can taste PTC while the remaining 25% cannot.

PTC-like chemicals are found in the Brassica family of vegetables, such as cabbage, brussels sprouts, and broccoli. People who can taste PTC often do not enjoy eating these vegetables, since they taste bitter to them. Non-tasters tend not to notice bitter tastes and therefore may be more likely to become addicted to nicotine (which is bitter).

PTC-tasting ability has also provided information related to human evolution. Populations in Sub-Saharan Africa, and people who are descended from this area, contain at least five forms of the gene. Some of these forms confer a PTC-tasting ability that is intermediate between taster and non-taster. However, with only a few exceptions, only two forms – taster and non-taster – are found in populations outside of Africa and their descendants. This is consistent with the out-of-Africa hypothesis of modern human origins.

Some scientists think that tasters have fewer cavities, suggesting that there might be a substance in the saliva of tasters that inhibits the bacteria that cause cavities to form. Others think that PTC tasting may be in some way connected with thyroid function.

PTC tasting was a chance discovery in 1931.

Name _____

Date _____

An Inventory of My Traits – Survey

What combination of these traits do you have? Complete the survey to find out.

1. I have detached earlobes Yes No
2. I can roll my tongue Yes No
3. I have dimples Yes No
4. I am right-handed Yes No
5. I have freckles Yes No
6. I have naturally curly hair Yes No
7. I have a cleft chin Yes No
8. I have allergies Yes No
9. I cross my left thumb over my right when I clasp my hands together Yes No
10. I can see the colors red and green (I am not color blind) Yes No
11. The hairline on my forehead is straight. Yes No
12. I am a: Male Female

Adapted from "Alike But Not The Same" in Human Genetic Variation, NIH Curriculum Supplement Series 1999. <http://science-education.nih.gov>

Name _____

Date _____

An Inventory of My Traits – Data Table

How many people in your group have each trait?
Fill in the data table below by counting the number of people who marked “yes” and the number of people who marked “no” for each trait.

| TRAIT | YES | NO |
|------------------------------|-----|----|
| Detached earlobes | | |
| Tongue rolling | | |
| Dimples | | |
| Right-handed | | |
| Freckles | | |
| Naturally curly hair | | |
| Cleft chin | | |
| Allergies | | |
| Cross left thumb over right | | |
| See the colors red and green | | |
| Have a straight hairline | | |

Adapted from “Alike But Not The Same” in Human Genetic Variation, NIH Curriculum Supplement Series 1999, <http://scienceeducation.nih.gov>

Name _____

Date _____

An Inventory of My Traits – Graph

Make a bar graph showing how many people in your group answered “yes” for each trait.
Be sure to label each trait under the bar you draw for it.

