

Inherited Traits

Wyoming Science, Mathematics

Objectives:

- Students will make a chart and collect data identifying various traits among their classmates.
- Students will understand that they share many traits.
- Students will be able to identify a trait as inherited from the parent.
- Students will record data on specific traits.

Background:

Have you ever noticed that sisters look alike? Or have you even had difficulty telling them apart. Their inherited traits are what make their physical appearance so similar. An inherited trait is a particular genetically determined characteristic or quality that distinguishes somebody. The traits of children are determined by the traits passed on from their parents. This is why we often hear, “She has her mother’s eyes,” or, “He has his father’s chin”. People are noticing the inherited traits.

It is often easy to determine inherited traits in family members, but what about traits that are often unnoticed? You may even possess many of the same traits as your classmates although you are not directly related to those individuals.

Parent organisms pass traits to their offspring so there are often similar characteristics seen in both parent and offspring. Inherited human traits include:

- Ability to roll your tongue or not
- Attached or unattached earlobes
- Dimples or freckles
- Naturally curly or straight hair
- Hitchhiker’s or straight thumb
- Color-blindness or normal color vision
- Widow’s peak or straight hairline
- Color of skin and hair
- Cleft or smooth chin

Humans have numerous traits, but some traits are more frequently seen. Between 70- 90% of the population have free-hanging earlobes, can roll their tongue, are right-handed and can taste PTC (a bitter tasting chemical that can be placed on the tongue). Because these traits occur most often within the population they are called high frequency traits. The rate of frequency is a statistical term that helps scientists determine how often an inherited trait occurs. Frequency is important in discovering how much of the population differs (or is similar) from the whole.



Standards

Science

Life Systems: 1.2
Science As Inquiry: 2.1, 2.2, 2.3, 2.4
History and Nature of Science
in Personal & Social Decisions:
3.1A

Mathematics

Algebra: 4.1
Data Analysis & Probability:
5.1, 5.2

Materials

- “An Inventory of My Traits” worksheets
- Measuring Tape
- A plant, fish and bread mold
- PTC (Phenylthiocarbamide) test papers, one strip for each student
- Hard candy
- Long strips of paper
- Post-It notes (3” x 3”) cut in half, four for each student

Estimated Time

60 Minutes

Grades 5-6

notes:

Activity Procedures:

1. Begin the activity by telling the class something like, “If a visitor from another planet walked into this classroom, he might easily conclude that humans all look very much alike.” If students complain that this is not true, answer something like, “You are certainly more like one another than you are like this plant (point to the plant). Or this fish (point to the fish). And for sure, you are more alike than anyone of you is like the bread mold (hold up the baggie with the bread mold). Humans-Homo sapiens-have a set of traits that define us as a species, just like all other species have a set of traits that define them.
2. Continue the activity by determining just how similar the students are to each other. Pair each student with a partner. Distribute the “An Inventory of My Traits” activity sheet to each student. Have each student help their partner determine their specific traits.

Activity 1

Teaching Tip: While carrying out this activity, teachers need to be sensitive to the ethnic make-up of their class and to any individual traits that would stereotype any student in a negative way. It is NOT recommended that students be assigned to conduct surveys of their family members for heritable traits.

1. Using the “Inventory of My Traits” worksheets, conduct the following game with several volunteers. Provide hard candies to counteract the bitter taste of the PTC paper.
2. Have students use a partner to compare their traits.
3. Choose a volunteer to determine his or her “uniqueness” as compared with the other students.
4. Ask all of the students to stand.
5. Invite the volunteer to begin to identify his or her inherited traits for each of the 15 human traits listed on their completed worksheet. Begin with the first trait and proceed sequentially. As the volunteer lists his or her traits, direct the students who share the volunteer’s similarities to remain standing. Direct all other students to sit.
6. Continue in this fashion until the volunteer is the only person still standing. Count how many traits the class had to consider to distinguish the volunteer from all other students in the class.
7. Repeat as desired with another volunteer

Activity 2 (Mathematics Integration)

1. Using the “Inventory of My Traits” worksheets, have the students determine the frequency of the traits within the classroom population. A master copy of an overhead is included with this lesson on page 6.
2. List each observed trait and the number of times it was observed on the board and create a frequency table like the one shown. Ask: How many in the class have this trait? (Use tally marks to emphasize math skills)

Example:

Observed Trait Number Observed

Brown Eyes // // // // // // // // // // // //

Blue Eyes // // //

Green Eyes // // // // //

Total Population = 30

Show students how to determine percentages for the frequency:

$$\frac{\text{Number Observed} \times 100}{\text{Total Population}} = \text{Percentage}$$

For Example:

Brown Eyes would be $15 \times 100 / 30 = 50\%$

50% of the class population has brown eyes

** Wrist circumference and hand span will need to be shown in a graph format to see the similarities. The instructor should model the procedure to calculate the average for these statistics. **

3. Ask the students if the majority of their population had high frequency traits. Remember that because of variation in populations it is quite possible that a low frequency trait will be observed in the majority of the students in your classroom. Determine which traits had the highest rate of frequency.
4. Compare your results of these class traits to known frequencies for the general population. Frequency Chart shown on page 4.
5. Create a Wall Graph for the last four traits: hand span, wrist circumference, foot length and finger length. Discuss the amount of variation present in the class for these traits.

vocabulary:

- *trait*
- *genetic*
- *statistic*
- *population*
- *propability*

notes:

To Make a Wall Graph:

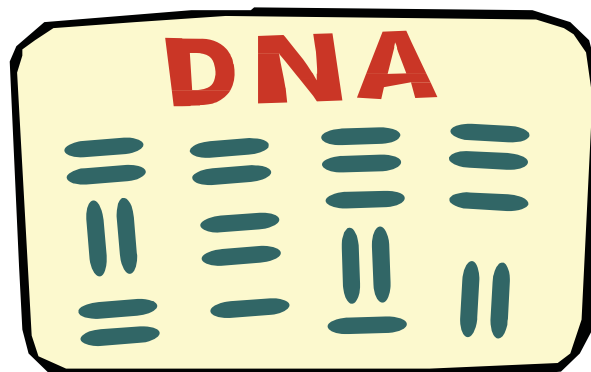
- Use adding machine tape or long strips of paper to create the X and Y axes for the graph. Mark centimeter placements for each bar of the graph on the X axis and label it “Number of Centimeters”. Mark 3-inch placements for each Post-It note on the Y axis and label it “Number of Students”.
- Tape the axes on the wall.
- Have each students add their data to the graph using a Post-It note, creating a bar graph.

After making the Wall Graphs, model how to calculate the class average for these four traits.

| Trait | Frequency Form 1 | Frequency Form 2 |
|------------------|----------------------------------|-----------------------------------|
| Gender | Female - Approximately 50% | Male - Approximately 50% |
| Earlobes | Unattached (free) -more frequent | Attached - less frequent |
| Thumb Extension | Straight Thumbs 64-75% | Hitchhiker’s thumb -25-36% |
| Tongue Roll- ing | Can tongue roll - 65% | Cannot tongue roll - 35% |
| Cheek Dimples | Dimples - more frequent | No dimples -less frequent |
| Handedness | Right handed -more frequent | Left-handed -less frequent |
| Hand Clasping | Left over right - 55% | Right over Left - 44% |
| Hair Curl | Curly hair - more frequent | Straight hair - less frequent |
| PTC Tasting | Can taste PTC - 70% | Cannot taste PTC - 30% |
| Hairline | Widow’s peak - more frequent | Straight hairline - less frequent |

Ask the students:

- Is there a pattern in the traits expressed in our classroom population?
- Why do you think there are so many similarities or differences within our population?
- Why would a scientist care whether populations were similar or different?



Activity 3 (Homework Connection)

1. Have your students make predictions based upon the frequency of inherited traits for another population. In pairs of students, have them form their own population survey.
2. Have them administer their survey to their chosen population (it could be another class or a group of students who were reading in the library during lunch).
 - Have them report their discovered frequencies and answer the following questions in their scientific report.
 - Why did you select your particular population?
 - Which frequency was the most surprising to you?
 - Why are your results significant? (describe why a
 - Were your high frequency traits really the highest in your population, or was it determined that they were low frequency traits in your population.
 - What other inherited traits do you think scientists should look for? Why?
 - If you were to compare your population with a different population do you think that the results would be the same? Why or why not?

Extensions/Adaptations/Integration:

- Have your students examine why America is called a “melting pot of race and culture”. Relate this to what they have been learning about inherited traits and the great immigrations of populations to North America in the 1800s.
- Have your students visit “The Gene Scene” web site.

This site is a virtual way to give them more understanding about what makes them unique. Or order “The Gene Science” student readers, one classroom set of 30 is \$25.00. Visit the American Museum of Natural History at www.amnh.org for activities on-line, or email Eric Hamilton at center@amnh.org to order your student readers.

Additional Resources:

Visit: Utah Ag in the Classroom - Teacher Resources

Heredity, A Link to Your Past!

Grades 4-6 (Instructional Unit/Lesson Plan)

This instructional unit discusses how members of any given species transfer traits from one generation to the next.

Free lesson plan downloads. <https://extension.usu.edu/aitc/cart/index.cfm?keywords=&category=0&secondary=27&Submit=Search>

notes:

Rate of Frequency

Total Population

| Observed Traits | Number Observed | Percentage of Population with Trait |
|--|-----------------|-------------------------------------|
| Tongue rollers Non-tongue rollers | | |
| Detached earlobes Attached earlobes | | |
| Hitchhikers thumb Straight Thumb | | |
| Males Females | | |
| Dimples No Dimples | | |
| Right-handed Left-handed | | |
| Cross left thumb over right Cross right thumb over left | | |
| Freckles No freckles | | |
| Curly hair Straight hair | | |
| Wrist Circumference average | | |
| Allergies No allergies | | |
| Can taste PTC Cannot taste PTC | | |
| Color blind Can see all colors | | |
| Widow's peak No widow's peak | | |
| Hand span average | | |

An Inventory of My Traits

How similar are you and your partner? Complete this inventory and compare it with your partner's inventory.

- | | | |
|---|---|---------------------------------|
| 1. I am a: | <input type="checkbox"/> Male | <input type="checkbox"/> Female |
| 2. I have detached earlobes. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 3. I have a hitchhiker's thumb. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 4. I can roll my tongue. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 5. I have dimples. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 6. I am right handed. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 7. I cross my left thumb over my right. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 8. I have freckles | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 9. I have naturally curly hair. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 10. I have a cleft chin. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 11. I have allergies. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 12. I can taste PTC. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 13. I can see the colors red and green (color blindness). | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 14. I have a widow's peak. | <input type="checkbox"/> Yes | <input type="checkbox"/> No |
| 15. The length of my left index finger is: | _____ centimeters (nearest centimeters) | |
| 16. The length of my left foot is: | _____ centimeters (nearest centimeters) | |
| 17. My hand span is: | _____ centimeters (nearest centimeters) | |
| 18. My wrist circumference is: | _____ centimeters (nearest centimeters) | |