State Your Traits

Basic Principles of Inheritance (High School Level)

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Contents:

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Classroom Version & Teacher Instructions
Sample teacher dialog is given for guidance only. Sample student responses are given below the teacher dialog. Commentary and extra teacher background are given in italics.

Audience
The target audience is high school students in introductory biology class. However, the genetic traits topic is fascinating to a number of diverse groups. We have used other versions of parts of this activity with students as young as 10 or with both expert and non-expert adult groups.

Should I do all of the activities?
This unit contains 6 activities:

- Activity 1: PTC Tasting
- Activity 2: My Traits
- Activity 3: Genetic Traits Tree
- Activity 4: The Traits Game
- Activity 5: Which Trait is Dominant?
- Pedigrees Extension Activity

Activities 1, 2, 3, and 4 should be done in sequence with no pause between activities. If a lack of class time necessitates, break the sequence between activities. Activity 5 is a more advanced activity and should be done some time after 1-4, but not necessarily the same day. The Pedigrees Extension Activity teaches the same concept in Activity 5, and is most appropriate as a challenge activity or for students with more exposure to genetics concepts.

In addition, a science festival activity based on Activity 3, Genetic Traits Tree, is provided (p. 10). This activity is suited for any event in which a booth format is used, e.g. a science festival, science fair, open house, etc.

Classroom Set-Up
These activities works well with small groups of students (~4) clustered around tables.

Materials
- Genetic Traits Tree (see pp. 17, 21)
- Large wall graph for PTC tasting data (draw on butcher paper or blackboard)
- PTC paper, 100 strips/vial (order #AP7989 from Flinn Scientific, 800-452-1261)
- Waste containers (e.g. paper cups, for used PTC papers, candy wrappers)
- Hard candies
- Genetic traits biophoto sheets (order #AA-17-4831 & #AA-17-4832 from Carolina Biological, 800-334-5551)
- Hand mirrors (1–2 per four students)

• Scissors (1–2 per four students)
• Post-its, $1^1/_2$" X 2" green and yellow (or any two different colors)
• Leaf pictures, green and yellow (see p. 22-23)
• Genetic traits data forms (see p. 18–20)

Preparation
Onto each table, place these materials for each group: vials of PTC paper, waste containers, hard candies, hand mirrors, post-its, scissors. Attach Genetic Traits Tree and large PTC wall graph to wall.

Activity 1: PTC Tasting --

Teacher: You will find a vial of paper strips on your table. These paper strips have small amounts of the chemical PTC spotted onto them. Small amounts of PTC are harmless to humans.

T: Remove one strip from the vial and place it on your tongue. Hold it there for a few seconds. Allow it to get wet, but do not chew it or swallow it. Discard the paper into the waste container on your table. After tasting the paper, you can help yourself to a candy if you'd like.

T: What did the paper taste like?

> Bitter, nasty, like dandelion stems, like brussels sprouts, like old vegetables, like when you throw up, like nothing, like paper.
>
> *If they wish, students who report the paper tasted like nothing/paper should be allowed to taste a second paper to confirm their "result."*

T: Raise your hand if you tasted something when you put the paper into your mouths.

> It looks like about ___ % of students are tasters.

T: Now raise your hand if you didn't taste anything or all you tasted was a paper taste.

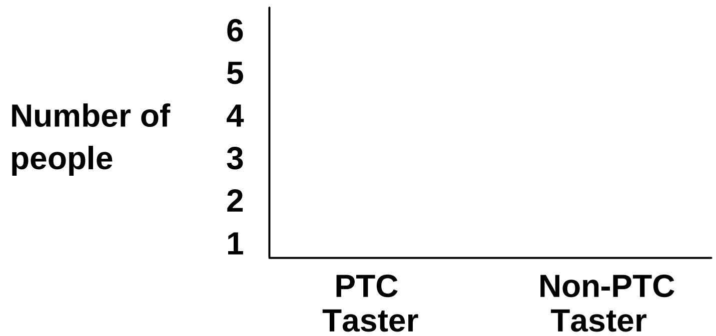
> It looks like about ___ % of students are non-tasters. These numbers correlate well with what is seen in the North American population. 70% of people in North America are tasters of PTC, and this figure may be higher in children. The frequency of tasters also varies depending on race. People of African descent, for example, taste PTC at higher frequencies than people of Northern European descent.

T: Let's collect our taste **data** and make a graph on the wall.

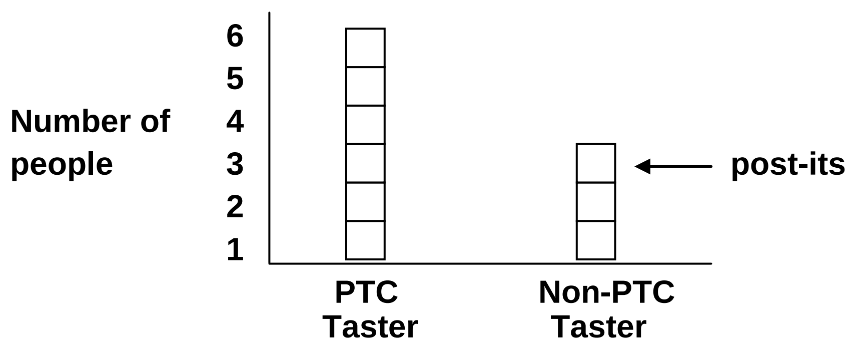
T: Look at the empty graph on the wall. Add your own PTC tasting data to the empty graph on the wall. Take a post-it note and place it on the graph in either the "PTC taster" or "Non-PTC taster" column. Place your post-its one on top of the other, so that a vertical bar is formed in each column. Use a green post-it if you're male and a yellow post-it if you're female.

> *See diagram of graph on the next page. Note: other colors of post-its can be substituted for green and yellow.*

EMPTY GRAPH
PTC Tasters vs. Non-PTC Tasters



COMPLETED GRAPH
PTC Tasters vs. Non-PTC Tasters



T: What does the graph tell us?

Some people can taste PTC, some can't. More people can taste it than can't. Some males and females can taste it. some males and females can't (no difference between the sexes in ability to taste).

T: Yes. We **vary** in our ability to taste PTC.

T: Sometimes it's not easy to tell at a glance if the male and female groups have similar frequencies of tasters and non-tasters. Please take a minute to do that calculation at your desk and then let's look at the result.

Students should each do a calculation that looks similar to this (sample data are provided):

Sex	No. PTC Tasters (M or F)	Total PTC Tasters (M+F)	% PTC Tasters (M or F)
Male	13	18	72%
Female	5	6	83%

You can ask students if they think any difference seen between males and females is a true *difference or due to some other factor (e.g. small sample size, as is seen in the small female population above).*

Although the PTC tasting trait seems to be present at about equal frequencies in male and female populations, this is not true for all genetic traits. For example, some traits are determined by genes on the sex chromosomes, or the expression of some genes is affected by its environment (male or female body).

T: Why do you think some people taste PTC and other people can't? What could account for this **variation?**

An inherited difference, they got it from their parents, people who can't taste PTC have dulled their tastebuds with spicy foods.

At this point you may or may not choose to confirm for students that we do get the ability to taste PTC from our parents.

Students often wonder why we even have the PTC tasting trait. This can be discussed now or after more genetic traits have been introduced. Scientists don't know for sure why humans have a PTC tasting trait, but they do have some ideas. If you have already covered evolution and natural selection in your classroom, students will understand that the PTC tasting trait may have been helpful long ago when humans were hunter-gatherers. What if a person put a poisonous leaf or root in his mouth? Would it help him survive if it tasted bitter to him and prompted him to spit it out?

Activity 2: My Traits ---

T: There are other differences between us too. Look at these two people...

Ask for two volunteers to come stand at the front of the room.

T: How are they alike and how are they different?

One is girl and one is a boy (or they're both boys/girls), their hair color, hair texture (curly, straight, wavy), eye color, skin color, clothes, height, weight, eye glasses, hair length and style, ears pierced or not, both have one nose (or two ears, two hands, etc.)

Note: teacher or another volunteer can keep a list of traits on blackboard as students give responses.

T: Your **traits** are the way you look. And also sometimes what you can do, such as taste PTC. There are other traits that we can't see, such as your bloodtype.

T: Which of the traits on our list (or that you've named) can be changed?

Hair style and length, pierced ears, weight, hair color

T: Which traits can't?

Sex, hair color, hair texture, eye color, skin color, height, vision, one nose, etc.

Students may give a variety of responses, and some traits may be placed in both categories, for example, hair color. Some traits such as height and weight may not fit clearly into either category because they are influenced by both genetic and environmental factors.

T: Why can't some traits be changed?

You were born with them... (see extended response below)

T: Where do these traits come from?

Your parents... (see extended response below)

T: Most traits that can't be changed are inherited from our parents. These are called **genetic** traits. It is our **genes**, contained in our **DNA**, that determine these traits. Some traits, like pierced ears, can be changed. These traits are not inherited from our parents. They are determined by what we do and how we live, in other words, by our **environment.** A few traits, like hair color, can be changed, but the hair color we are born with is a genetic trait. Our hair can change color if it is dyed with chemicals or exposed to lots of sun. Some traits are affected by both our genetics and the environment, such as height and weight.

Optional Assessment. *Ask students which traits on the blackboard list are inherited and which are environmentally determined.*

Activity 3: Genetic Traits Tree -----------------------------------

T: Now we're going to look at a few more traits that make each of us similar and each of us unique.

Pass out biophoto sheets, data forms, and leaves. People will score traits and record on forms. Biophoto sheets are not passed out with the other materials prior to Activity 1 because they can be very distracting.

T: Fill in the data form with your traits. Work with a partner. Some traits are hard to score on your own, so ask your partner and use your mirror.

Give students 5-10 minutes to complete their forms. Circulate among the groups to monitor progress. There should be lots of informal discussion. Help students resolve scoring ambiguities for traits such as attached vs. free earlobes and mid-digital finger hair (see Appendix I for scoring tips).

Students are often intensely interested in genetic traits and may ask what other traits are inherited. Additional examples are hair, eye, and skin color, although these are determined by multiple genes instead of single genes like the other traits. Other single gene traits are freckles, color blindness, and hitchhiker's thumb. We have also heard but haven't seen this verified in the scientific literature that some simple behaviors are determined by single genes, such as sneezing in bright sunlight or which thumb a person places on top when clasping his hands together. Some classes may wish to investigate some of these other traits. Some inherited disorders such as sickle cell disease and hemophilia are also determined by single genes. Three blank rows have been left in the data form for classes that want to score additional traits.

T: Raise your hand if you can roll your tongue. How many people have dimples? Widow's peak? How many people can roll their tongues, have dimples, AND have widow's peak?

Very few students will have all three traits.

T: I've only asked you about 3 genetic traits, and already there are very few people in the class with that particular combination. The many possible combinations of all of our genes is our species' **genetic variation** or **genetic diversity.**

T: Now you'll compare your combination of traits to the combinations of others in the class.

- Cut out a leaf from the yellow and green papers found on your table. If you are a boy, cut out a green leaf. If you are a girl, cut out a yellow leaf.
- On your leaf, mark your traits for tongue rolling, earlobes, and PTC tasting. Note: other trait combinations can also be used.
- If you wish, write your name on your leaf. *Note: optional only. Allows students to easily find their leaf later and compare their trait combination to others in the class.*
- Each branch of the tree *(point to large tree taped to wall)* represents a different combination of traits. Tape your leaf to the end of the correct branch for you. *This will take several minutes. There will be a logjam as students gather around the tree to tape their leaves up. It may work more smoothly to ask tables one at a time to tape their leaves to the tree.*

T: The tree is like the graph—a way to organize and display data. What do you observe when you look at the tree?

There are leaves on every branch, the leaves are spread out all over the tree, some branches don't have leaves, one side of the tree has most of the leaves, some branches have mostly yellow or green leaves, there are no branches with only one color of leaf.

Note: If the first trait you choose for the first branching point on the tree is a trait that most people in the class have, then the leaves will appear mostly on one side of the tree. We recommend you choose a trait for the first branching point that is not found predominantly in one form only, e.g. PTC tasting is probably not a good choice for the first branch.

If responses are slow in coming, teacher can ask questions to guide discussion, such as:

- Are the leaves all or mostly on the same branch of the tree? All or mostly on the same side of the tree?
- Are there any branches with mostly yellow or green leaves? If so, what does that mean? *(it means some combinations of traits are more often found in one sex than the other)*

- Is there anyone in the class that has the same three traits as you *(leaf at the end of the same branch)*? If yes, are there any other traits that distinguish you from him or her?

Science Festival Variation: The Genetic Traits Tree

This variation is suited for any event in which a booth format is used, e.g. a science festival, fair, or open house. Choose three traits that are easy to score, such as Earlobe attachment, Tongue rolling, and Mid-digital finger hair. The PTC tasting trait is best used when the booth is not too crowded or you have adequate staff. Note also that for simplicity, only one color of leaf is used.

Materials:

- Genetic Traits Tree (large)
- Paper leaves pre-printed with traits on green paper
- Tape
- Genetic Traits illustrations (included in this document)
- Pencils or pens

Instructions

1. Hang Genetic Traits Tree on Wall. Lay out leaves, traits illustrations, and pencils/pens on your table.
2. As participants approach your table, ask if they would like to add their genetic traits information to the tree. Explain that each leaf on the tree represents one person's traits. Where will their genetic traits place them on the tree?
3. Ask participants to use a pen to mark their traits on the leaves, using the illustrations on the hand-out to aid them.
4. Participants should next stick their leaf to the correct branch on the tree, using the tape. They will probably need help with this step.
5. Participants may be interested to see how common their trait combination is (how many leaves on their branch). Or they may want to compare their traits with a relative in attendance.
6. If the participant wants to know more, use this as a jumping off point for a discussion of other genetic traits, genetic and environmental contributions to phenotype, the tremendous amount of genetic variation in our species, etc.

Activity 4: The Traits Game --

The game is modified from an activity contained in Human Genetic Variation (1999).

T: Let's look at just how unique each of us is. How many genetic traits do you think you would have to look at to identify yourself as unique—different from all the others in the class?

> *Allow students to volunteer their predictions: e.g. 5, 6, 7, 10, or 50 genes, etc. Now test the prediction by playing the game.*
>
> *Have all students stand up. Ask for a volunteer. Volunteer reads off his first genetic trait from the list, e.g. "I am a PTC taster." Students who cannot taste PTC sit down. Volunteer reads off next trait: e.g. "I have attached earlobes." Students with free earlobes sit down. Volunteer continues reading off traits, one at a time, until he is the only student left standing. Ask students to count how many traits it took before the volunteer was unique. How well did this number match their prediction? The number is usually around 5-7.*

T: It only took _______ traits (fill in number) before ___________ (fill in name of volunteer) was unique. Let's try it again.

> Repeat game one or two more times. You may find your students want to play this game until each student has had a chance to be the volunteer. This isn't necessary but can be done if there is extra time. Students can be fascinated by who is the last person left standing with the volunteer and may christen this student the volunteer's "twin." Students will be surprised to see that their "twins" often don't look very similar to themselves at all.

T: We've only looked at a few traits today, ones we can easily see. And we've seen that it takes about 6 (or whatever number your class has observed) traits to set one person apart from the rest of us. And there are so many more traits we haven't scored today, such as bloodtype and other traits inside of us that control how our bodies work. If you could look at all of our traits, there would many, many differences between us. Our many traits reflect our many genes. Scientists now estimate that each of us has about 40,000 different genes.

Saving Time ——————————————————————————————

One way to compress the time these activities take is to eliminate having students score all the traits on the data form during Activity 3. Don't pass out the data forms. Instead pass out just the biophoto sheets and have students score only the traits on the leaves, e.g. PTC Tasting, Tongue Rolling, and Earlobe Attachment, or whichever three traits you have chosen.

Activity 5: Which Trait is Dominant? ------------------------------

Activities 1–4 can stand on their own. Activity 5 is somewhat more advanced and whether you can use it will depend on how much genetics your students have already learned. In Activity 5, students will learn how to determine whether a particular allele is dominant or recessive. This activity should be done only if students have previously learned about dominant and recessive traits.

T: We've looked at a number of genetic traits in our class. And I've heard some of you talking about which traits might be dominant and recessive. For some traits, we know which form of the trait is dominant or recessive. For some traits we don't know at first glance.

T: How might you determine whether a particular trait is dominant or recessive? How would you do this in fruit flies or peas?

> *Look at the trait in several generations of a family. Make some crosses. The most common trait is the dominant one.*
>
> The latter statement is a common misconception among "beginning geneticists." Explain to students that the frequency of a trait in the population is not related to whether it is dominant or recessive. There is a common belief that recessive traits will eventually "die out" or vanish from a population. This is not true unless there is a selective disadvantage to having the recessive trait. Students in advanced genetics courses will recognize that the answer to this question lies in the Hardy-Weinberg formula. Most introductory high school classes, however, will not be familiar with Hardy-Weinberg or other quantitative population genetics concepts.

T: (Return to the idea of doing genetic crosses to test dominance—if students have not mentioned this, you can bring it up.) So one way to test whether a genetic trait is dominant is to perform crosses? That's true. But we're people, not fruit flies! You can't just make crosses to test your ideas about which allele is dominant and which is recessive in people. So how can you tell?

For several traits, ask students to assay their parents' traits at home. This should be an **optional** assignment and will only work in families where both biological parents can participate. Students who are part of adopted or blended families will have to sit this one out, so this should be a no credit assignment. If you like, you may use the *Individual Data Collection Form for Relatives of Students* that is provided in this document.

Ask students to report their phenotype and those of their two parents. Record the data in a table like the one below for PTC tasting. We have provided actual data for PTC tasting. Make similar tables for other traits.

Parents	Student can taste PTC	Student cannot taste PTC
Taster x Taster	20	2
Taster x Non-taster	10	5
Non-taster x Non-taster	0	3

Only in the case where the "cross" is Recessive x Recessive will there be no students of one phenotype in the pooled data. Therefore, from the data above, the Non-taster trait must be the homozygous recessive. Taster could not be recessive because offspring of both phenotypes are produced in situations where the parents are both tasters. Note that if the pool size is too small, it may not be possible to come to a conclusion. If more than one of your classes is doing this activity, it may be best to pool data among classes.

Please be aware that some **paternity issues** could possibly arise here, so if the data are not 100% "correct," be prepared with some sort of explanation (e.g. ambiguity in trait scoring, spontaneous mutation, etc.) Alternatively, have students analyze data that you provide, such as the PTC data in the table above.

For those wishing to skip the *What Trait Is Dominant?* activity but yet still make use of the dominant/recessive information for each trait, here is what is known about which traits are dominant:

Tongue Rolling	Dominant
Widow's Peak	Dominant
Dimples	Dominant
Free Earlobes	Dominant
Mid-digital Finger Hair	Dominant
PTC Taster	Dominant

Pedigrees Extension Activity ——————————————————————————

This activity provides another way for students to determine which trait is dominant and which is recessive and can be used instead of Activity 5. It is particularly appropriate for teachers emphasizing the development of critical thinking skills. Students will need to have prior knowledge of drawing and interpreting pedigrees, or the activity can be used to introduce pedigree basics.

Option A

Have students draw pedigrees of the inheritance of specific traits in their own families. They should gather trait information from as many relatives as they can, including parents, siblings, grandparents, etc. Students can then use the data they've gathered to try to answer questions such as:

- Do children always have the same traits as their parents?
- As their brothers and sisters?
- Is the trait dominant or recessive?

To examine whether a trait is dominant or recessive using pedigrees, have one student present his pedigree for a trait to the class by either drawing on the blackboard or using the overhead projector. Then ask the student to present a hypothesis as to whether the trait is dominant or recessive. The student must state a hypothesis (e.g. "the PTC tasting trait is dominant") that is consistent with his data, not just say "the PTC tasting trait could be dominant or recessive based on my pedigree."

Now ask if there are other students in the class with pedigrees that either support or contradict the first student's hypothesis. Have them share their pedigrees with the class.

In this fashion, the dominance of a trait may be determined. This method is really similar to the method shown on the previous page, but less quantitative.

Option B
If it is impractical to have students collect family data or if it is too uncomfortable to ask only students who are part of "biological families" to collect data, you can use the set of pedigrees that are included with this document. Four numbered pedigrees have been provided for the trait of free and attached earlobes. These pedigrees must be used in sequence. Make overheads of each pedigree.

1. Divide the class into four groups and pass out a pedigree overhead to each group. (Note: two pedigrees are provided on each master, so cut the papers in half before distributing.)

2. Ask all the groups to examine their pedigrees. and think about whether the pedigree tells them anything about whether the trait is dominant or recessive.

Discuss the first two questions given in Option A above: Do children always have the same traits as their parents? As their brothers and sisters?

3. Now ask students to think about whether the pedigree gives them any information on whether the trait is dominant or recessive. Ask group 1 to examine their pedigree and come up with a hypothesis about which trait is dominant based on their pedigree data. As discussed in Option A above, **the students must make a**

hypothesis, not an either/or statement. Ask group 1 to come to the front of the room, place their pedigree on the overhead projector, and tell the class their hypothesis. Have the student presenting the pedigree write in the genotypes consistent with their hypothesis next to each individual in the pedigree.

4. Ask each of the other groups in sequence to come to the front of the room and present their pedigree to the class. Each group must tell if their pedigree is consistent with or contradicts group 1's hypothesis. (Note: Only group 1 makes a hypothesis.) Each group should write in the genotypes on their pedigree. Immediately after each group's presentation, let students from other groups comment on whether they agree or disagree and why or why not.

By the fourth pedigree, students should have proved whether the hypothesis was correct or not.

If the original hypothesis is false, students can test the opposite hypothesis by quickly looking at all the pedigrees and verifying that they are consistent with the new hypothesis.

Note: the definitive pedigree will always be one where the two parents have the same trait and their offspring include some children with each trait. In this pedigree type, the dominant trait will be the one that the parents have (they must both be heterozygotes).

References

Human Genetic Variation (1999). NIH Curriculum Supplement Series. National Institutes of Health. http://science-education.nih.gov/supplements.

National Science Education Standards (1996). National Research Council. National Academy Press, Washington DC. http://search.nap.edu/html/nses/html.

Traits Information & Tips on Scoring the Traits--------------------

These traits are determined by single genes and have a dominant and recessive form: Tongue Rolling, Widow's Peak, Dimples, Cleft Chin, Earlobe Attachment, Finger Hair, and PTC Tasting. Scoring these traits is fairly unambiguous and information to help you is given below. The biophoto sheets contain color photographs of a number of common genetic traits. Some traits on the sheets are more difficult to score.

Tongue Rolling. The ability to roll your tongue upwards to form a closed tube. The sides of your tongue will meet at the top of the tube if you can roll your tongue.

When students first learn tongue rolling is an inherited trait, they may be surprised and comment that if only people who can't roll their tongues would practice, they could learn to roll their tongues too. Tongue rolling, then, is an example of a "motor skill" that is inherited. Is a good golf swing or a good free throw shot any different?

Widow's Peak. If you have Widow's Peak, your forehead hairline will have a downward dip in it, as in a heart. Lift up the hair of your forehead to score this trait. People without widow's peak have a smooth hairline with no dip. Men starting to go bald (or already bald) may be unable to score this trait.

Dimples. Indentations in the cheeks, especially noticeable when smiling. Score as "yes" only if a dimple on each side is present. Score those with a dimple on only one side as "no."

Cleft Chin. A dimple or cleft in the center of the chin.

Earlobe attachment. Earlobes are attached if the bottom lobe is attached directly to the head. Earlobes are free if the lobe hangs free.

Finger Hair. Officially known as *Mid-digital Finger Hair.* Consider your fingers to have 3 segments, top, middle, and bottom. If hair is present on the middle segment of any finger, even just one hair, you have mid-digital hair. Do not score the bottom segment of your fingers for hair, just the middle segment. Look closely, as is can be difficult to score. Hair may be present on only one finger or very fair, especially in children..

PTC Tasting. The ability to taste the chemical PTC, which is harmless when ingested in small amounts. To a non-taster, the paper strips have no taste.

Directions for Making and Using the Tree ----------------------------

Making the Tree

You will need to make a Genetic Traits Tree to use with Activity 3. A diagram showing the outline of a tree can be found later in this document. Your finished tree need not be identical, but the branch structure should be similar. The completed tree should be about 3 to 4 feet tall and about 3 feet wide. How do you make the tree? One solution is to use a drawing program to create a computer document of a large tree for printing out on a large color printer/plotter. For increased durability, the tree poster can be laminated at a photocopy store. A perfectly adequate tree can also be created by cutting the trunk and branches out of brown butcher paper and taping them together. It is best to use light brown paper so that labels on the branches can be easily read.

Labeling the Tree

Label the two branches on each side of each fork in the tree with a particular trait. The traits are your choice. Use pencil or tape on labels so that you can try different traits on your tree if you use it again. The activity works best if the first trait (nearest to the trunk) is one where both forms are common in the population (e.g. attached and free earlobes). A good combination of traits is Earlobe Attachment, PTC Tasting, and Tongue Rolling. If you use this combination, you would label the tree as follows. Start at the bottom of the tree and move up the trunk to the first fork. Label the left branch "Attached Earlobes" and the right branch "Free Earlobes." Continue up the Attached Earlobes branch. When the branch forks, label the left branch "PTC Taster" and the right branch "Non-PTC Taster." Do the same on the "Free Earlobes" branch. Continue up the branch and at the final fork, label the new branches "Tongue Roller" and "Non-tongue Roller." Repeat for the remaining branches.

Labeling the Leaves

It is best to label the leaves with the traits in the order students will encounter them as they work up the tree from bottom to top. Included in this document are a leaf template with the trait combination Earlobe Attachment/PTC Taster/Tongue Roller and a template with blank leaves, so that you can fill in your own.

Individual Data Collection Form

Please provide the following information:

Date: ________________ **School:** ____

Sex (circle one): Male Female **Age:** _________

Fill in your traits in the table below. If you are uncertain, mark neither option.

Trait	**Yes**	**No**
Tongue Rolling		
Widow's Peak		
Dimples		
Earlobe Attachment	(attached)	(free)
Mid-digital finger hair		
PTC Taster	(taster)	(non-taster)
Cleft Chin		

Individual Data Collection Form

Please provide the following information:

Date: ________________ **School:** ____

Sex (circle one): Male Female **Age:** _________

Fill in your traits in the table below. If you are uncertain, mark neither option.

Trait	**Yes**	**No**
Tongue Rolling		
Widow's Peak		
Dimples		
Earlobe Attachment	(attached)	(free)
Mid-digital finger hair		
PTC Taster	(taster)	(non-taster)
Cleft Chin		

Individual Data Collection Form for Relatives of Students

Please provide the following information: **Date:** ________________ **Age:** _________

Your relation to student: ____

School: ______________________________ **Sex** (circle one): Male Female

Fill in your traits in the table below. If you are uncertain, mark neither option.

Trait	**Yes**	**No**
Tongue Rolling		
Widow's Peak		
Dimples		
Earlobe Attachment	(attached)	(free)
Mid-digital finger hair		
PTC Taster	(taster)	(non-taster)
Cleft Chin		

Please staple this form to student form

Individual Data Collection Form for Relatives of Students

Please provide the following information: **Date:** ________________ **Age:** _________

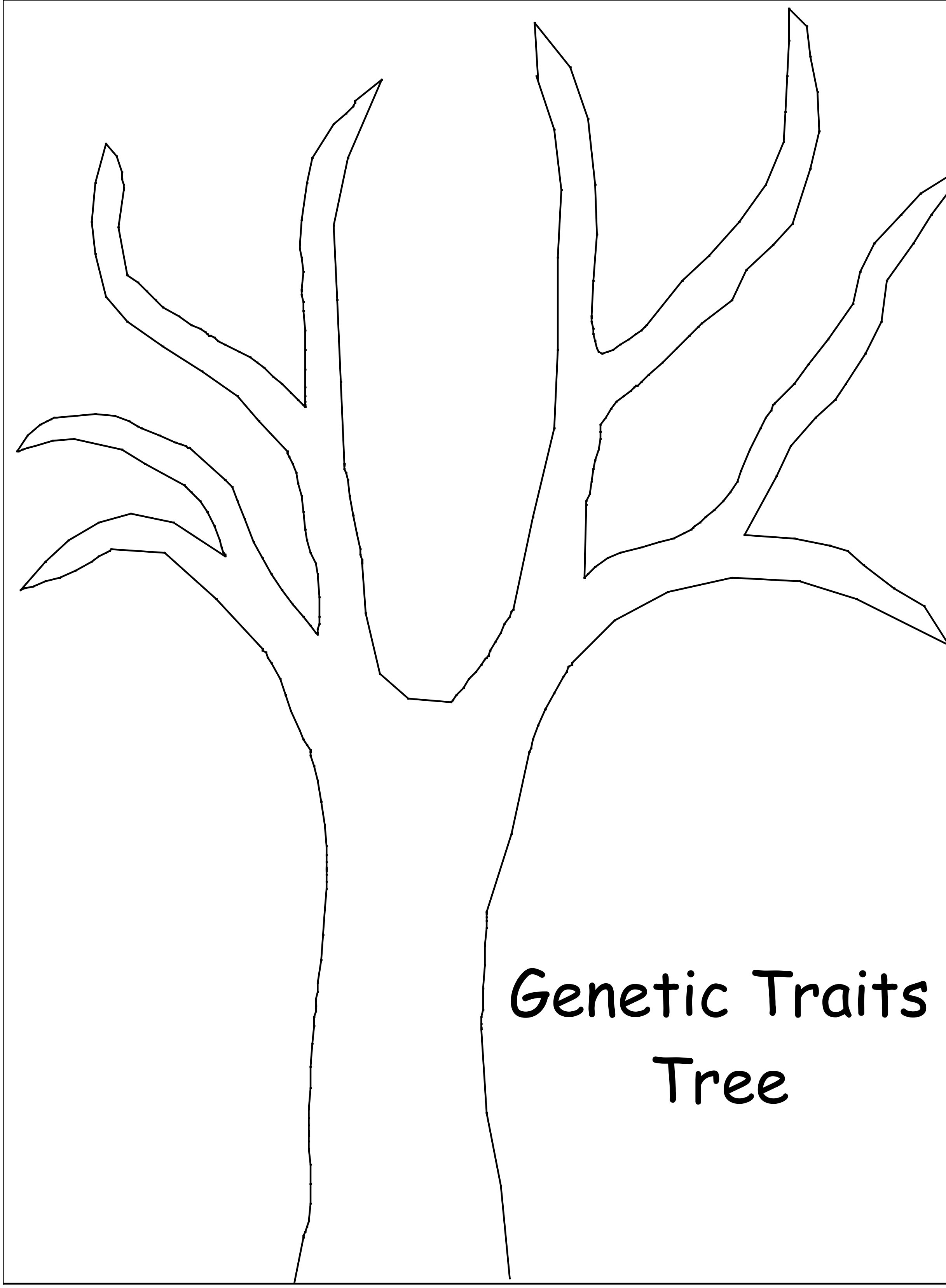
Your relation to student: ____

School: ______________________________ **Sex** (circle one): Male Female

Fill in your traits in the table below. If you are uncertain, mark neither option.

Trait	**Yes**	**No**
Tongue Rolling		
Widow's Peak		
Dimples		
Earlobe Attachment	(attached)	(free)
Mid-digital finger hair		
PTC Taster	(taster)	(non-taster)
Cleft Chin		

Please staple this form to student form



Genetic Traits Tree