Science Education Essentials

Institute for Creation Research

Sample Curriculum Supplement
Student Activities

Grades K-2

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Teacher Information

Who Are My Mother and Father?

Brief Description: The student will sort a set of pictures to identify parents and offspring. The student will identify uniquely human physical characteristics that set us apart from animals and recognize that humans have special abilities that animals do not have.

Biblical References to Science Concepts:

And God created great whales, and every living creature that moveth, which the waters brought forth abundantly, after their kind, and every winged fowl after his kind: and God saw that it was good....And God made the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind: and God saw that it was good. (Genesis 1:21, 25)

And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. (Genesis 1:28)

Time Required: 30 minutes

Background Information:

All living things were created and blessed by God. God designed each kind of living thing to reproduce according to its kind.

Humans share some similarities with animals in terms of biology. We were designed by the same Creator, but humans did not descend from animals as evolutionists claim. Humans were uniquely created by God in His image and have uniquely human characteristics.

Objectives: The student will be able to:

1. Identify humans as different from animals.
2. Identify and describe uniquely human characteristics.

Key Concepts/Vocabulary with Definitions:

1. **Characteristic:** A distinguishing feature or quality.
2. **Offspring:** The young of particular parents.
3. **Unique:** One of a kind.

Science Process Skills:

- Observing
- Communicating
- Classifying
- Inferring

Teacher Information

Learning Preferences:

- **Verbal/Linguistic:** Vocabulary
- **Interpersonal:** Giving Feedback
- **Intrapersonal:** Focusing/Concentration Skills and Thinking Strategies
- **Logical/Mathematical:** Problem Solving
- **Spatial:** Drawing and Coloring

Materials and Tools:

- One set of picture cards of animals, humans, and their offspring for every two students (provided)
- A stuffed animal or animal figurine
- A doll

Instructions for Teachers:

1. Place the doll and animal toy so the students can see both of them. Discuss with the students how they know the doll represents a human.

2. Provide a set of picture cards for every two students. First, ask the students to sort the cards into two groups: animals and humans. Then, ask the students to sort the cards into family groups: mother, father, and offspring.

3. Discuss the characteristics that make the humans look different from the animals. Discuss the characteristics of each animal that indentified the family as belonging together.

4. Discuss the qualities and behaviors of humans that are different from animals: i.e., humans can learn to read, write, and do math; humans can use these skills to reason, solve problems, and create structures, machines, art, and music; humans are made in God's image and have an eternal spirit.

Discussion Questions:

1. Why are animals different from humans? *(Humans are made in God's image.)*

2. How are humans and animals alike? *(Humans and animals grow from babies to adults. Both humans and animals breathe, move, and eat. Both get water in some manner, and most have some way to protect themselves from weather and other living things that are enemies.)*

3. Can animals change into humans or humans change into animals? *(No, because animals and humans were separately created by God. Humans were created in God's image.)*

Assessment: Ask the students to identify characteristics of humans that make us different from animals.

Extensions:

- Related fiction picture books: *Are You My Mother?* by P. D. Eastman, *Is Your Mama a Llama?* by D. Guarino and S. Kellogg, *Stellaluna* by J. Cannon.
- Look at pictures or toys of fairies, elves, centaurs, mermaids, etc. Identify the human and non-human characteristics. Clarify that these are "pretend" creatures.

Teacher Information

AAAS Benchmarks:

- **1B/P3** Describing things as accurately as possible is important in science because it enables people to compare their observations with those of others.
- **5A/P1** Some animals and plants are alike in the way they look and in the things they do, and others are very different from one another.
- **5C/P2** Most living things need water, food, and air.

NSES Life Science Standards:

- **4CLS 1.2** Each plant or animal has different structures that serve different functions in growth, survival, and reproduction. For example, humans have distinct body structures for walking, holding, seeing, and talking.

Tenets of Scientific Creationism (Henry M. Morris, 1980):

The phenomenon of biological life did not develop by natural processes from inanimate systems but was specially and supernaturally created by the Creator.

Student Activity

Who Are My Mother and Father?

Science Education Essentials

Institute for Creation Research

Sample Curriculum Supplement
Student Activities

Grades 3-5

www.icr.org

Teacher Information

Inventory of Traits

Brief Description: The students will inventory their own observable genetic traits and compare those with other students. They will be able to describe how they are uniquely created by God and yet part of the same human family.

Biblical References to Science Concepts:

I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well. (Psalm 139:14)

And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it. (Genesis 1:28)

Time Required: 60 minutes

Background Information: See the Heredity Fact Sheet.

Objectives: The student will be able to:

1. List easily observable genetic traits in humans.
2. Describe traits that show we are all part of the human family.
3. Explain how different observable physical traits show evidence of God's creation of unique individuals.

Key Concepts/Vocabulary with Definitions:

1. **Genes:** Genetic material that provides most of the information that determines natural appearance; genes generally have two alleles.
2. **Genetic Inheritance:** Genes inherited from parents that determine a person's natural appearance and influence some of that person's behavior.
3. **Inherit:** For someone to receive something from his/her parents or grandparents, or people who came before; to receive a physical characteristic.
4. **Physical Traits:** Observable and unobservable characteristics related to a person's physical appearance and internal physical makeup.
5. **Trait:** A distinguishing characteristic or quality.

Science Process Skills:

- Observing
- Communicating
- Collecting Data
- Predicting
- Analyzing Data
- Making Graphs

- Hypothesizing
- Investigating

Learning Preferences:

- **Verbal/Linguistic:** Vocabulary and Creative Writing
- **Interpersonal:** Cooperative Learning Strategies and Giving Feedback
- **Intrapersonal:** Focusing/Concentration Skills and Thinking Strategies
- **Logical/Mathematical:** Problem Solving
- **Spatial:** Drawing and Coloring

Materials and Tools:

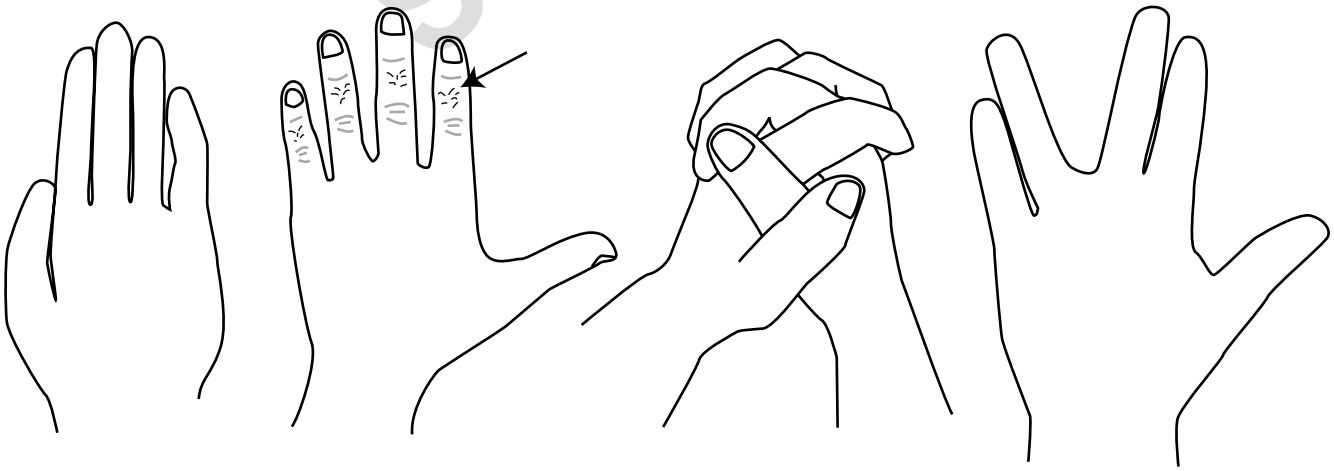
- Paper
- Pencils
- Crayons or markers
- Inventory of Traits student activity sheet
- Human Characteristics Cards (one set per group)
- Graph

Pre-Lab Instructions:

1. Define and discuss the word *trait*. Use a student or yourself to describe what is meant by observable physical traits.

2. Have all the students stand up. Demonstrate or show a picture of a hitchhiker's thumb—when a person's thumb tip can naturally bend back 90 degrees. Tell the students who have a hitchhiker's thumb to sit down. Point out the relative number of students standing and sitting for the trait. (For example, if you have 12 students and three have a hitchhiker's thumb, you will have three out of 12 with a hitchhiker's thumb; converted to a fraction, this is 3/12.)

3. Continue this process with the traits shown below. The trait "mid-digital hair" is present if any hair is on any middle section of any finger. For the hand crossing trait, hands should be clasped in the way the person automatically does this.



bent little finger | **mid-digital hair** | **left thumb on top when hands crossed** | **"Vulcan"**

4. Review the traits using the Human Characteristics Cards or actual students to ensure that the students understand traits about earlobes, dimples, freckles, chins, and hairlines.

5. Ask the students what the observable characteristics are that make each of us unique. Explain that some traits may be common, but each person's overall combination of individual traits makes him/her unique.

Instructions for Teachers:

This activity will be done in pairs or groups. **Note:** Do not pass out all the charts and tables at once. This will be too confusing for the students.

1. Students will collect data about themselves by completing Data Collection Chart 1: My Traits. They will help each other with their personal inventory, or let them use a mirror to look at their traits.

2. After completing Data Collection Chart 1, the students will tally group information on Data Collection Chart 2: Group Traits.

3. Draw a chart on the board representing Data Collection Chart 3: Class Traits. Choose one member of each group to tally the information. Or use this as a class activity and discuss the traits while doing it. This would be a great time to discuss the uniqueness of each person.

4. From the Class Traits chart on the board, students will complete Data Collection Chart 3: Class Traits. They will now have all the information about their classmates.

5. Using the information in Chart 3: Class Traits, demonstrate how to complete the bar graph for hair. Also show the students how to convert the information into a fraction by having them fill in the number of classmates with that particular characteristic and the total number in their class. They will need help with the first one. The students will complete the remaining graphs and questions on their own.

Common Misconceptions: Students may think that they inherit traits from aunts, uncles, cousins, and siblings because family members resemble each other. However, traits can only be inherited from parents, and by extension from grandparents.

Discussion Questions:

1. What do you notice about the observable physical traits of the people in your class? *(Answers may vary.)*

2. What are some traits that can be passed from the parents to the offspring? *(Hair, skin color, etc.)*

3. Do all people have the same observable/physical genetic traits? Why or why not? *(Answers may vary.)*

4. Using Psalm 139:14, describe how the different observable/physical traits show evidence of God's creation of unique individuals. *(Answers will vary.)*

5. Describe why you are unique or different from the other students in the group. *(Answers will vary.)*

6. Why do some people have the same physical traits and others do not? *(Answer should stress heredity, which can lead into the inheritance lesson.)*

7. Does having the same traits mean that you are related to that person? *(Not exactly. It means that people with the same trait have some of the same genes. We have the same genes because, if we go far enough back in history, we are all part of the human family that began with Adam and Eve.)*

Assessment:

Ask the students to identify the most and least common trait in their group, or the class as a whole. The bar graph may also be used as an assessment.

Extensions:

1. Collect the trait data from the whole class by creating a large wall chart and have the students fill in the data from each group. The class can then make a large bar graph representing the whole group.

2. Students can collect data on the traits of their family members on the Data Collection Chart: Traits of Family Members. Discuss traits they have in common with other family members. Remind students that traits are inherited from parents and indirectly from grandparents. Ask why they might share traits with siblings, aunts, uncles, or cousins. **Note:** Be sensitive to students who are adopted or living in blended families. Some traits are likely to be the same but are inherited from biological parents.

3. Play an Inventory Game. Have all the students stand. Have one of the students become the leader and say one of his/her traits at a time, beginning with, "I am a girl" or "I am a boy." For each trait, have all students who do not share that trait sit down. Students who share the trait remain standing. Once the students have been seated, they should not get up again. Continue in this way until the leader is the only one standing. Count the number of traits it took to establish that the leader is different from everyone else in the whole group. This reinforces that we are fearfully and wonderfully made and each person is unique. Play another round with a different student leader.

AAAS Benchmarks:

- **5B/E1** Some likenesses between children and parents are inherited. Other likenesses are learned.
- **5B/E2** For offspring to resemble their parents there must be a reliable way to transfer information from one generation to the next.

NSES Life Science Standards:

- **4CLS2.1** Plants and animals have life cycles that include being born, developing into adults, reproducing, and eventually dying. The details of this life cycle are different for different organisms.
- **4CLS2.2** Plants and animals closely resemble their parents.
- **4CLS2.3** Many characteristics of an organism are inherited from the parents of the organism, but other characteristics result from an individual's interactions with the environment. Inherited characteristics include the color of flowers and the number of limbs of an animal. Other features, such as the ability to ride a bicycle, are learned through interactions with the environment and cannot be passed on to the next generation.

Tenets of Scientific Creationism (Henry M. Morris, 1980):

The phenomenon of biological life did not develop by natural processes from inanimate systems but was specially and supernaturally created by the Creator.

Heredity Fact Sheet

Allele: One of a pair in genes that determines differences in physical characteristics.

Dominant Trait: Visible trait in an organism. The effects of dominant traits show up in the appearance from the expression of these genes.

Genes: Units of heredity that provide most of the information that determines natural appearance. There are generally two alleles for each gene.

Genetic Inheritance: Genes inherited from your parents that determine your natural appearance and influence some of your behavior.

Heredity: The passing of traits from parents to offspring. There can be physical and behavioral traits.

Inherited Human Traits:

- **Cleft Chin:** Cleft chin is a dominant trait; a smooth chin is a recessive trait.
- **Dimples:** A dominant trait; lack of dimples is a recessive trait.
- **Earlobe Attachment:** Earlobe attachment is a recessive trait; unattached earlobe is a dominant trait.
- **Freckles:** Presence of freckles is a dominant trait; absence of freckles is a recessive trait.
- **Gender:** Boy or girl.
- **Hairline Shape:** Widow's peak is a dominant trait; straight hairline or no widow's peak is a recessive trait.
- **Thumb Extension:** Straight thumb is a dominant trait; "hitchhiker's thumb" is a recessive trait.
- **Tongue Rolling:** Ability to roll the tongue is a dominant trait; lack of the ability to roll the tongue is a recessive trait.

Gregor Mendel: Known as the Father of Genetics, Mendel was an Austrian monk who began growing peas in his garden at his monastery in 1856. He noticed that pea plants had different traits. Some of the traits he observed are height (tall or short), color, and shape.

Physical Traits: Can be observable characteristics. Our own individual combination of traits is what makes each of us unique. Physical traits are determined by specific segments of DNA called genes. Every organism passes along some of its traits to the next generation when it reproduces. Some common traits that are passed along are eye, hair, and skin color, height, and some health traits. One example of a health trait would be color blindness. Traits such as height and weight are inherited but are influenced by other factors, such as diet. Skin color is an inherited trait but may change due to sun exposure.

Recessive Trait: Trait that an organism might have that is not visible. The effects of recessive traits are masked.

Trait: A distinguishing characteristic or quality. When an offspring is formed, its traits are determined by a combination of genes from each parent. Each parent contributes one-half of the genes for each trait.

And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth. (Genesis 1:28)

And Adam called his wife's name Eve; because she was the mother of all living. (Genesis 3:20)

Wherefore, as by one man sin entered into the world, and death by sin; and so death passed upon all men, for that all have sinned. (Romans 5:12)

Inventory of Traits

Problem: What unique physical traits do you have? What physical traits do you have that are in common with others in your class?

Define the term traits:

_____

_____

Procedure:

1. Collect data about yourself by completing My Traits (Data Collection Chart 1).
2. After completing My Traits (Data Collection Chart 1), tally your group information on Data Collection Chart 2: Group Traits.
3. One member of your group will write the completed tally from your group on a chart on the board so that you can complete Data Collection Chart 3: Class Traits.
4. Complete Data Collection Chart 3. You will now have all the information about your friends.
5. Use the information in Chart 3: Class Traits and complete the bar graphs. Your teacher will demonstrate how to complete the bar graph for hair and change the information into fractions.

Data Collection Chart 1: My Traits

Directions: Circle the answer that fits you.

I am a:	Boy	Girl
I have brown hair.	Yes	No
I have black hair.	Yes	No
I have blond hair.	Yes	No
I have red hair.	Yes	No
I have detached earlobes.	Yes	No
I have dimples.	Yes	No
I have freckles.	Yes	No
I have naturally curly hair.	Yes	No
I have a cleft chin.	Yes	No
I have a widow's peak.	Yes	No
I can roll my tongue.	Yes	No
I am right-handed.	Yes	No
I am left-handed.	Yes	No

Data Collection Chart 2: Group Traits

Directions: Compile the information for your group.

Trait	Total
How many in your group have brown hair?	_____
How many in your group have black hair?	_____
How many in your group have blond hair?	_____
How many in your group have red hair?	_____
How many in your group have detached earlobes?	_____
How many in your group have dimples?	_____
How many in your group have freckles?	_____
How many in your group have curly hair?	_____
How many in your group have a cleft chin?	_____
How many in your group have a widow's peak?	_____
How many in your group can roll their tongue?	_____
How many in your group are right-handed?	_____
How many in your group are left-handed?	_____

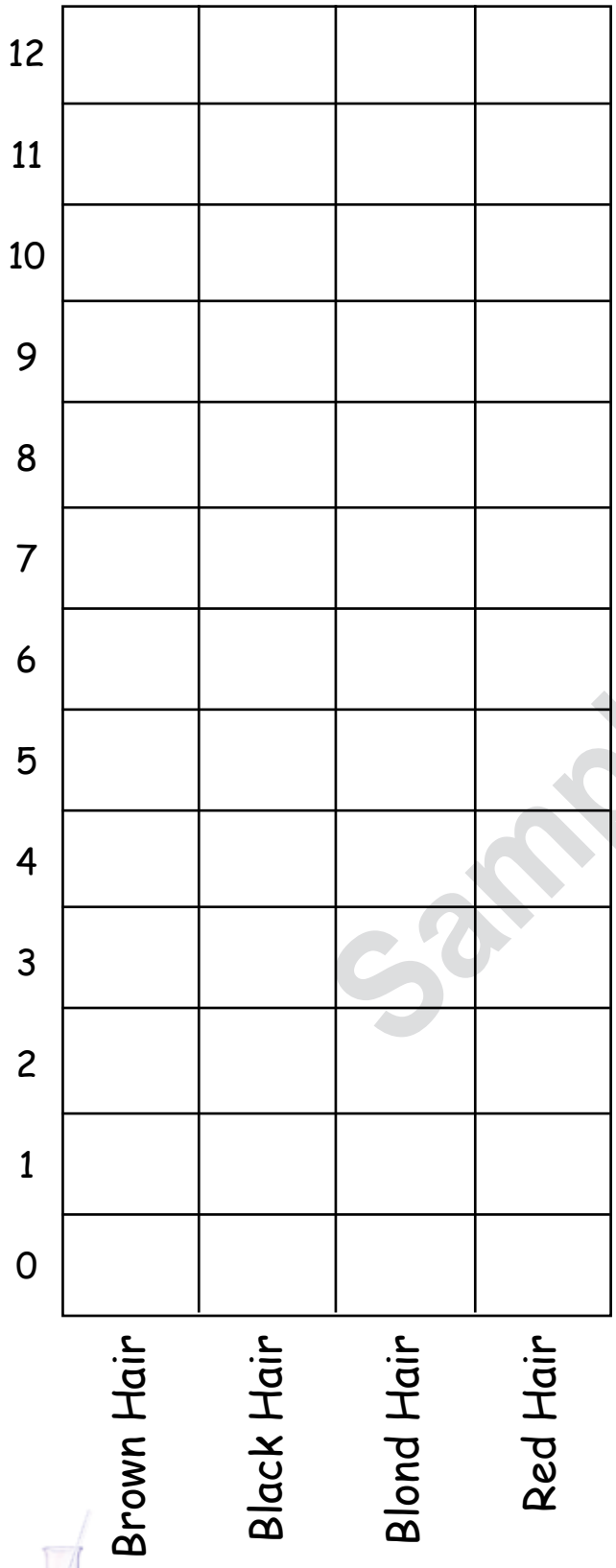
Data Collection Chart 3: Class Traits

Directions: Compile the information for your class.

Trait	Total
How many in your class have brown hair?	_____
How many in your class have black hair?	_____
How many in your class have blond hair?	_____
How many in your class have red hair?	_____
How many in your class have detached earlobes?	_____
How many in your class have dimples?	_____
How many in your class have freckles?	_____
How many in your class have curly hair?	_____
How many in your class have a cleft chin?	_____
How many in your class have a widow's peak?	_____
How many in your class can roll their tongue?	_____
How many in your class are right-handed?	_____
How many in your class are left-handed?	_____

Table 1: Color of Hair

Bar Graph: Color in the boxes for the number of people in the class with each hair color.



Out of _____ students,
_____ have brown hair.

Write as a fraction:

_____ # with brown hair / # in class

Out of _____ students,
_____ have black hair.

Write as a fraction:

_____

Out of _____ students,
_____ have blond hair.

Write as a fraction:

_____

Our of _____ students,
_____ have red hair.

Write as a fraction:

_____

Table 2: Earlobes

Bar Graph: Color in the boxes for the number of people in the class for the earlobe attachment trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Detached Earlobes													
Attached Earlobes													

Out of _____ students,
_____ have detached earlobes.

Write as a fraction: _____

Out of _____ students,
_____ have attached earlobes.

Write as a fraction: _____

Table 3: Dimples

Bar Graph: Color in the boxes for the number of people in the class for the dimple trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Dimples													
No Dimples													

Out of _____ students,
_____ have dimples.

Write as a fraction: _____

Out of _____ students,
_____ have no dimples.

Write as a fraction: _____

Table 4: Freckles

Bar Graph: Color in the boxes for the number of people in the class for the freckle trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Freckles													
No Freckles													

Out of _____ students,
_____ have freckles.

Write as a fraction: ____

Out of _____ students,
_____ have no freckles.

Write as a fraction: ____

Table 5: Hair Texture

Bar Graph: Color in the boxes for the number of people in the class for the hair texture trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Curly Hair													
Straight Hair													

Out of _____ students,
_____ have curly hair.

Write as a fraction: ____

Out of _____ students,
_____ have straight hair.

Write as a fraction: ____

Table 6: Cleft Chin

Bar Graph: Color in the boxes for the number of people in the class for the cleft chin trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Cleft Chin													
Smooth Chin													

Out of _____ students,
_____ have a cleft chin.

Write as a fraction: _____

Out of _____ students,
_____ have a smooth chin.

Write as a fraction: _____

Table 7: Hairline

Bar Graph: Color in the boxes for the number of people in the class for the hairline trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Widow's Peak													
No Widow's Peak													

Out of _____ students,
_____ have a widow's peak.

Write as a fraction: _____

Out of _____ students,
_____ do not have a widow's peak.

Write as a fraction: _____

Table 8: Tongue Rolling

Bar Graph: Color in the boxes for the number of people in the class for the tongue rolling trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Rolls Tongue													
Cannot Roll Tongue													

Out of _____ students,
_____ can roll their tongue.

Write as a fraction: _____

Out of _____ students,
_____ cannot roll their tongue.

Write as a fraction: _____

Table 9: Handedness

Bar Graph: Color in the boxes for the number of people in the class for the handedness trait.

	0	1	2	3	4	5	6	7	8	9	10	11	12
Right-Handed													
Left-Handed													

Out of _____ students,
_____ are right-handed.

Write as a fraction: _____

Out of _____ students,
_____ are left-handed.

Write as a fraction: _____

Discussion Questions:

1. What do you notice about the observable physical traits of the people in your class?

2. What are some traits that can be passed from the parents to the offspring?

3. Do all people have the same observable/physical genetic traits? Why or why not?

4. Using Psalm 139:14, describe how different observable physical traits show evidence of God's creation of unique individuals.

5. Describe why you are unique or different from the other students in the group.

6. Why do some people have the same physical traits and others do not?

_____

_____

_____

7. Does having the same traits mean that you are related to that person?

_____

_____

_____

Inventory of Traits

Data Collection Chart: Traits of Family Members

Add in other family members, including grandparents if possible.	Brown Hair	Black Hair	Blond Hair	Red Hair	Detached Earlobes	Attached Earlobes	Freckles	No Freckles	Curly Hair	Straight Hair	Cleft Chin	Smooth Chin	Widow's Peak	No Widow's Peak	Rolls Tongue	Cannot Roll Tongue	Right-Handed	Left-Handed	Dimples	No Dimples
Me																				
Mother																				
Father																				
Sister																				
Brother																				

Out of _____ family members,

_____ have brown hair

_____ have black hair

_____ have blond hair

_____ have red hair

Science Education Essentials

Institute for Creation Research

Sample Curriculum Supplement
Student Activities

Grades 6-8

www.icr.org

Taste Test

Brief Description: Using a taste test, students will describe that dominant traits will affect the proteins that our bodies produce. They will recognize that God created us to enjoy His creation through the sense of taste.

Biblical References to Science Concepts:

And the Lord God planted a garden eastward in Eden; and there he put the man whom he had formed. And out of the ground made the Lord God to grow every tree that is pleasant to the sight, and good for food; the tree of life also in the midst of the garden, and the tree of knowledge of good and evil. (Genesis 2:8-9)

How sweet are thy words unto my taste! yea, sweeter than honey to my mouth! (Psalm 119:103)

My son, eat thou honey, because it is good; and the honeycomb, which is sweet to thy taste. (Proverbs 24:13)

Time Required: 45 minutes

Background Information:

God created us to sense a vast variety of tastes so we could enjoy the things He created for us to eat. Our bodies get information through the sense of taste. Some tastes are pleasant or sweet, and some are bitter or sour. It is amazing the number of times the words "sweet" and "bitter" are used in the Bible to create an analogy in relationship to God's character, man's character, or the Word. If we did not have a sense of taste, these words would have little meaning to us.

Our ability to taste things is influenced by our genetic makeup, age, individual experiences, and the current surroundings.

The ability to taste the bitter compound phenylthiocarbamide (PTC) and related chemicals is bimodal, and all human populations tested to date contain some people who can and some people who cannot taste PTC. Seventy percent of people can taste PTC. Why this trait has been maintained in the population is uncertain, but this polymorphism may influence food selection, nutritional status, or thyroid metabolism. The gene product that gives rise to this phenotype is unknown.

There is conflicting evidence as to whether this trait is a result of either dominance or incomplete dominance. Some studies have shown that homozygous tasters experience a more intense bitterness than people who are heterozygous; other studies have indicated that another gene may determine taste sensitivity.

Sodium benzoate ($NaC_6H_5CO_2$) is a preservative used in salad dressings, vinegar, carbonated drinks, jams and fruit juices (citric acid), pickle, and condiments. It is found naturally in cranberries, prunes, plums, cinnamon, cloves, and apples.

Thiourea is a colorless crystalline chemical compound ($CS(NH_2)_2$) used in organic synthesis, in photography, etc.

Teacher Information

OBJECTIVES: The student will be able to:

1. Describe why taste preferences are different using genetics.
2. Portray God's plan for making food that is pleasant to the sight and nutritious.

KEY CONCEPTS/VOCABULARY WITH DEFINITIONS:

1. **Dominant Allele:** Only one copy of the allele (DNA variant) is needed to produce the phenotype referred to as the dominant phenotype.
2. **Recessive Allele:** A recessive allele does not produce a phenotype or the trait is not expressed if the other allele is dominant (heterozygous). If both alleles are recessive (homozygous), the recessive phenotype or trait is expressed.
3. **Taste Preferences:** Traits associated with recessive and dominant alleles giving one the ability to differentiate between sweet, bitter, sour, and other tastes.
4. **Trait:** A distinguishing characteristic or quality.

SCIENCE PROCESS SKILLS:

- Observing
- Communicating
- Collecting Data
- Inferring
- Predicting
- Analyzing Data
- Hypothesizing
- Investigating

LEARNING PREFERENCES:

- **Verbal/Linguistic:** Vocabulary and Creative Writing
- **Interpersonal:** Cooperative Learning Strategies and Giving Feedback
- **Intrapersonal:** Focusing/Concentration Skills and Thinking Strategies
- **Logical/Mathematical:** Problem Solving

MATERIALS AND TOOLS:

- PTC taste paper (can be purchased from a biological supply company or online)
- Sodium benzoate taste paper (can be purchased from a biological supply company or online)
- Thiourea taste paper (can be purchased from a biological supply company or online)
- Control taste paper (can be purchased from a biological supply company or online)
- Plastic snack bags to hold sets of taste papers
- Paper cups (one per student)
- Drinking water
- Paper plate (one per student)
- Variety of fruits, such as grapefruit, apples, oranges, blueberries, strawberries, pears, etc. (up to seven different kinds of fruit)

Pre-Laboratory Preparation:

1. Cut up the fruit into bite-sized pieces and put a sample of each onto the paper plates for each student.
2. Put one of each taste paper (four total) into a plastic snack bag for each student.
3. Put some water into the paper cups so that the students can cleanse their palates in between tasting.

Instructions for Teachers:

Explain to the students that God created us to sense a variety of flavors so that we could enjoy the things He created for us to eat. Our bodies get information through the sense of taste—some tastes are pleasant or sweet, and some are bitter or sour. Receptor cells in the taste buds on the tongue and throat, and nerve cells and their extensions called axons form pathways to the brain. Once the taste signal reaches certain areas of the brain, these areas detect and interpret the flavors.

Ask the students to hypothesize if they think we all taste things the same. Why or why not?

Background for developing hypothesis:

1. Students will taste several fruits and indicate on a Likert scale what they taste, from very sour/bitter to very sweet. (**Note:** Students tend to mark the Likert scale the same as their friends or lab partners; warn them to not discuss their taste preference before recording it. It is all right to be different.)
2. Students will record their taste preference for each fruit on their activity sheets by circling the appropriate number.
3. Compile each of their answers on the board. Ask the students why they think there are a variety of preferences as to the taste of the fruits they tested.
4. Students will then fill in their hypothesis on their activity sheets.

Procedure:

1. Students will taste each taste paper given to them in a plastic snack bag. They will use descriptors like "very" or "slightly" ("slightly bitter" or "very salty," for example). Encourage them to take a drink of water to clean their palates after they taste each paper.
2. Students will record the taste they experience in the Data Chart: Taste Test on their activity sheets for each taste paper. They should throw their papers away after tasting them.
3. Compile each of their answers on the board.

Discussion Questions:

1. On average, PTC papers taste bitter to 7 of 10 people (or 70 percent). How many in the class have the ability to taste the bitter PTC paper? Describe how well your class represents the norm for bitter taste. *(Answers will vary.)*

2. Compare the results from the taste paper test with your results from the fruit tasting test. How well do they match? *(Answers will vary.)*

3. Explain why there are so many variations in tasting the same thing. *(There are so many factors, including differences in genes, memories, and even temporary attitudes, that are involved in determining any given person's sense of taste that it is not possible for everyone to taste the same. This points to the idea that God made us all different because He likes variety.)*

4. The Bible uses analogies involving taste. How would our understanding of verses such as Psalm 119:103 or Proverbs 24:13 be different if we couldn't taste anything? *(We wouldn't be able to understand verses like these if we didn't sense tastes.)*

5. Read Genesis 2:8-9 and Revelation 19:9. What is one reason why you think God gave us the ability to taste? *(God made a variety of good foods for us to eat and enjoy, so therefore He gave us the ability to taste those good things He made.)*

Assessment:

Ask the students to write a paragraph explaining, genetically speaking, why people can either taste or not taste certain substances like PTC, but when it comes to substances that most people can taste (like those that comprise a banana's taste) individual descriptions vary? In other words, why is it that some substances either can or cannot be tasted, and other substances that can be tasted by everyone taste different to different people?

AAAS Benchmarks:

- **5B/H1** Some new gene combinations make little difference, some can produce organisms with new and perhaps enhanced capabilities, and some can be deleterious.
- **5B/H3*** The information passed from parents to offspring is coded in DNA molecules, long chains linking just four kinds of smaller molecules, whose precise sequence encodes genetic information.
- **5B/H4*** Genes are segments of DNA molecules. Inserting, deleting, or substituting segments of DNA molecules can alter genes. An altered gene may be passed on to every cell that develops from it. The resulting features may help, harm, or have little or no effect on the offspring's success in its environment.
- **5B/H5** Gene mutations can be caused by such things as radiation and chemicals. When they occur in sex cells, they can be passed on to offspring; if they occur in other cells, they can be passed on to descendant cells only. The experiences an organism has during its lifetime can affect its offspring only if the genes in its own sex cells are changed by the experience.
- **5B/H7** (SFAA)** Heritable characteristics can include details of biochemistry and anatomical features that are ultimately produced in the development of the organism. By biochemical or anatomical means, heritable characteristics may also influence behavior

NSES Life Science Standards:

- **8ASI1.1** Identify questions that can be answered through scientific investigations. Students should develop the ability to refine and refocus broad and ill-defined questions. An important aspect of this ability consists of students' ability to clarify questions and inquiries and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. Students should develop the ability to identify their questions with scientific ideas, concepts, and quantitative relationships that guide investigation.
- **8ASI1.2** Design and conduct a scientific investigation. Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables. They should also develop the ability to clarify their ideas that are influencing and guiding the inquiry, and to understand how those ideas compare with current scientific knowledge. Students can learn to formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.
- **8CLS2.3** Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.
- **8CLS2.4** Hereditary information is contained in genes, located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.
- **8CLS2.5** The characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment.
- **12CLS2.3** Changes in DNA (mutations) occur spontaneously at low rates. Some of these changes make no difference to the organism, whereas others can change cells and organisms. Only mutations in germ cells can create the variation that changes an organism's offspring.

Tenets of Scientific Creationism (Henry M. Morris, 1980):

The phenomenon of biological life did not develop by natural processes from inanimate systems but was specially and supernaturally created by the Creator.

Student Activity

Taste Test

Background for Developing a Hypothesis: Taste several fruits and indicate below on a Likert scale the taste.

Fruit 1: _____

-5 -4 -3 -2 -1 0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 2: _____

-5 -4 -3 -2 -1 0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 3: _____

-5 -4 -3 -2 -1 0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 4: _____

-5 -4 -3 -2 -1 0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 5: _____

-5 -4 -3 -2 -1 0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 6: _____

-5 -4 -3 -2 -1 -0 1 2 3 4 5

Sour/Bitter **Sweet**

Fruit 7: _____

-5 -4 -3 -2 -1 -0 1 2 3 4 5

Sour/Bitter **Sweet**

PROBLEM: Do we all taste things the same? Why or why not?

HYPOTHESIS:

Procedure:

God created us to sense a vast variety of flavors so we could enjoy the things He created for us to eat. Our bodies get information through the sense of taste—some tastes are pleasant or sweet, and some are bitter or sour. It is amazing the number of times the words "sweet" and "bitter" are used in the Bible to create an analogy in relationship to God's character, man's character, or the Word. If we did not have a sense of taste, these words would have little meaning to us.

Our ability to taste things is influenced by our genes as well as age, individual experiences, and the current surroundings. Receptor cells in the taste buds on the tongue and throat, and nerve cells and their extensions called axons form pathways to the brain. Once the taste signal reaches certain areas of the brain, these centers detect and interpret the flavors.

1. You will be testing for tastes. Record what you taste (sweet, salty, bitter, or tasteless, for example) using descriptors like "very" or "slightly." (Example: slightly bitter.) Take a drink of water to clean your palate after you taste each paper.
2. Taste the white paper and record what you taste (sweet, salty, bitter, or tasteless) in the Data Chart: Taste Test.
3. Do step 2 for the blue, pink, and yellow papers. Throw away each paper after tasting it.

Data Chart: Taste Test

	Control	PTC	Sodium Benzoate	Thiourea
TASTE				

Discussion Questions:

1. On average, PTC papers taste bitter to 7 of 10 people (or 70 percent). How many in the class have the ability to taste the bitter PTC paper? Describe how well your class represents the norm for bitter taste.

_____

_____

_____

2. Compare the results from the taste paper test with your results from the fruit tasting test. How well do they match?

_____

_____

_____

3. Explain why there are so many variations in tasting the same thing.

_____

_____

_____

4. The Bible uses analogies involving taste. How would our understanding of verses such as Psalm 119:103 or Proverbs 24:13 be different if we couldn't taste anything?

_____

_____

_____

5. Read Genesis 2:8-9 and Revelation 19:9. What is one reason why you think God gave us the ability to taste?

_____

_____

_____

Science Education Essentials

Institute for Creation Research

Sample Curriculum Supplement
Student Activities

Grades 9-12

www.icr.org

Fingerprint Genetics

Brief Description: Students will record and examine their fingerprints and those of their classmates. They will be challenged to infer the appropriate genotype. They will recognize that their uniqueness as a person is well-known to their Creator.

Biblical References to Science Concepts:

Fear ye not therefore, ye are of more value than many sparrows. (Matthew 10:31)

I will praise thee; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well. (Psalm 139:14)

Time Required: 45 minutes

Background Information:

Fingerprints are records of the tiny patterns on the skin surface of human fingers. Feet have unique patterns as well. They come from very small ridges that stand above troughs in the skin. The fine details of this ridge-trough pattern are products of several genes.

Fingerprints serve many purposes. They can identify people, since no two are alike. The use of fingerprint impressions for this has a long history. For example, ancient Babylonians used them, marked on clay objects, for identifying criminals.

They also serve to enhance sensory reception of touch. At the microscopic level, the raised portions of skin vibrate and transmit that information to specialized touch receptor neurons deeper in the skin. In addition, fingerprints are critical for gripping objects, as they offer specific surface friction advantages.

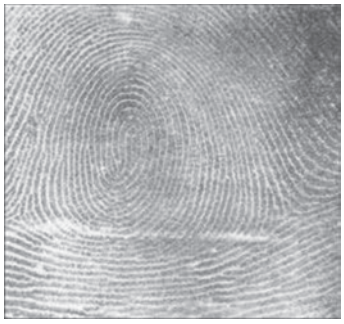
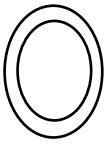
There are two basic categories of fingerprints. Patent prints require no processing to see, like those left in clay seals or those left from someone who touched wet paint. Latent prints require processing to enhance them enough to become visible. These finger patterns come from tiny amounts of skin oil left on an object that was touched.

Scores of chemicals can be used to record a fingerprint. Pencil "lead," which is actually graphite, will be used in this activity. Chemically, graphite is molecular carbon that takes the form of flat sheets. Under pressure, these will slide easily against one another, and tiny fragments can slide into the grooves of a finger's friction ridges, enabling detection and recording of a print.

There are three fundamental fingerprint patterns: the whorl, arch, and loop. There are about seven variations of these: the radial loop, double loop, central pocket loop, tented arch, plain arch, accidental whorl, and plain whorl. The fundamental patterns appear to correspond with certain genes, but the variations show that specific fingerprints are expressions of even more genes. Nevertheless, the three fundamental patterns can be used to illustrate the standard Mendelian inheritance pattern of dominance.

Teacher Information

For this procedure, the whorl will be assigned the genotype FF, the arch pattern the genotype ff, and the loop pattern the genotype Ff. Their appearances are as follows:

Genotype	FF	Ff	ff
Genotype condition	Homozygous dominant	Heterozygous	Homozygous recessive
Appearance			
Trait	Whorl	Loop	Arch
General Diagram			

Images: Public domain

Objectives: The student will be able to:

1. Deduce common patterns in fingerprints.
2. Describe how the variable expression of a few genes leads to an inexhaustibly complex supply of fingerprint patterns.
3. Express appreciation to God for His handiwork in the fine details of their lives, including finger ridge patterns.

Key Concepts/Vocabulary with Definitions:

1. **Dominant:** In the Mendelian inheritance pattern with two copies of a gene, one each of two different versions of the gene that is expressed during embryonic development to the exclusion of the other version.
2. **Fingerprint:** Impression of a finger's unique ridge pattern.
3. **Genotype:** The types of genes, or the gentic makeup, of an individual.
4. **Heterozygous:** With two possible forms of a gene, the condition of one individual having one copy of one form and one copy of the second form.
5. **Homozygous:** With two possible forms of a gene, the condition of one individual having both of them the same form.

6. **Phenotype:** Expressions of alleles that determine what an organism looks like.

7. **Recessive:** In the Mendelian inheritance pattern with two copies of a gene, one each of two different versions of that gene, the gene that is expressed during embryonic development only in the absence of the dominant form.

Science Process Skills:

- Observing
- Collecting Data
- Pattern-seeking
- Inferring

Learning Preferences:

- **Logical/Mathematical:** Problem Solving
- **Interpersonal:** Cooperative Learning Strategies and Giving Feedback
- **Tactical:** Hands-on

Materials and Tools:

- Pencils
- Clear adhesive tape
- Fingerprint Genetics student activity sheet (one per student)
- Moist handwipes to clean fingers afterwards

Instructions for Teachers:

Explain to the students that everyone has a unique pattern of grooves on their fingers. Even identical twins have different patterns. This is not called a fingerprint, but any representation of it is. This lab will make fingerprints (prints, or images of the unique finger skin groove patterns). Whereas the specific detailed patterns are unique to each, nevertheless general patterns are inherited. This fact also follows from the Genesis account of creation. Although God's stated intention was for Adam and Eve to be fruitful and make more people like themselves, nevertheless each person is unique, individually accountable to the Creator, and loved by Him.

If the students are not familiar with the standard Mendelian genetic inheritance pattern, they need to be taught this before the lab, including the vocabulary above. And they should have had some practice with a Punnett square.

Explain to the students that since finger grooves are a product of a host of different proteins, and since each of those proteins has a unique inheritance pattern, they are the product of a complicated mixture of genetic and developmental factors. Nevertheless, discerning the general whirl, loop, and arch patterns of fingerprints can serve to illustrate human heredity.

Familiarize the students with the whirl, loop, and arch fingerprint patterns, as well as the genotype of each.

Procedure:

Part 1: Obtaining Fingerprints

1. Students will trace an outline of their hands on their activity sheets.
2. Students will rub pencil "lead" onto a designated square on their activity sheets.
3. They will then coat a finger, starting with the thumb, with the graphite by rolling it on the square.
4. The fingerprint will then be transferred to a piece of tape.
5. That tape will be placed onto the "thumb" they traced.
6. Students will repeat steps 3-5 for each of the other four fingers on the same hand.

Part 2: Analyzing Fingerprints

1. Each student, with help from a partner if needed, should determine which of the three general patterns best fits each fingerprint.
2. They will record the appropriate genotype from the chart below the print on their activity sheets and then work through the discussion questions. They will need access to a marker board to record class data.

Discussion Questions:

1. Did every finger have the same genotype? Record the ratio of duplicate to unique genotypes from your and your partner's two fingerprinted hands. *(Answers will vary.)*
2. After adding your personal ratio data to a large chart accessible to the class, record the ratio of duplicate to unique genotypes from the entire class. Describe any patterns that may be in this data. *(Answers will vary.)*
3. Share notes with at least five other classmates, and survey which of their fingers had the same genotype and which were different. Based on this data, do all fingers generally have the same genotype? If not, which fingers usually shared the same genotype? *(Answers will vary.)*
4. Choose one of your fingerprints and determine all the possible genotypes of your parents for that same finger. If possible, analyze your parents' and maybe even grandparents' fingerprints to see how closely you can determine the parent genotypes. *(Answers will vary.)*
5. Describe the qualities of an algorithm or the kinds of coded building instructions that would produce a pattern that was consistent and recognizable, yet would produce subtle differences every time it was used to build with. For example, would random gibberish work for such a code? Would a rigid short code that produces perfect clones do the job? *(A code that produces variations on a pattern could not be gibberish or simple or short. In fact, it would have to be very complicated. It would even have to be more complicated than the pattern it ends up producing.)*
6. What would it take to build such a code? Since our Creator actually did that when He made Adam and Eve, and since this code applies only to a tiny part of the human body, what does this say about the intelligence or other attributes of the Lord Jesus, who formed us and our fingerprints in our mothers' wombs? *(It would take a supergenius to build a code that produces variations on complicated patterns. The fact that our bodies have these kinds of codes and the fact that our bodies were created by the Lord Jesus together mean that the Lord Jesus must be a supergenius.)*

Assessment:

Using the fingerprint diagrams provided at the beginning of this activity as a reference, sketch the general fingerprint phenotype for the following genotypes: FF, Ff, ff.

AAAS Benchmarks:

- **5B/M1b*** In organisms that have two sexes, typically half of the genes come from each parent.
- **5B/M2a** In sexual reproduction, a single specialized cell from a female merges with a specialized cell from a male.
- **5B/H2** The sorting and recombination of genes in sexual reproduction results in a great variety of possible gene combinations in the offspring of any two parents.
- **5B/H6b** Different parts of the genetic instructions are used in different types of cells, influenced by the cell's environment and past history.
- **5B/H7** (SFAA)** Heritable characteristics can include details of biochemistry and anatomical features that are ultimately produced in the development of the organism. By biochemical or anatomical means, heritable characteristics may also influence behavior.

NSES Life Science Standards:

- **8ASI1.2** Design and conduct a scientific investigation. Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables. They should also develop the ability to clarify their ideas that are influencing and guiding the inquiry, and to understand how those ideas compare with current scientific knowledge. Students can learn to formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.
- **8CLS2.1** Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.
- **8CLS2.2** In many species, including humans, females produce eggs and males produce sperm. Plants also produce sexually—the egg and sperm are produced in the flowers of flowering plants. An egg and sperm unite to begin development of a new individual. That new individual receives genetic information from its mother (via the egg) and its father (via the sperm). Sexually produced offspring never are identical to either of their parents.
- **8CLS2.3** Every organism requires a set of instructions for specifying its traits. Heredity is the passage of these instructions from one generation to another.
- **8CLS2.4** Hereditary information is contained in genes, which are located in the chromosomes of each cell. Each gene carries a single unit of information. An inherited trait of an individual can be determined by one or by many genes, and a single gene can influence more than one trait. A human cell contains many thousands of different genes.
- **8CLS2.5** The characteristics of an organism can be described in terms of a combination of traits. Some traits are inherited and others result from interactions with the environment.
- **12CLS2.1** In all organisms, the instructions for specifying the characteristics of the organism are carried in DNA, a large polymer formed from subunits of four kinds (A, G, C, and T). The chemical and structural properties of DNA explain how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated (by a templating mechanism). Each DNA molecule in a cell forms a single chromosome.
- **12CLS2.2** Most of the cells in a human contain two copies of each of 22 different chromosomes. In addition, there is a pair of chromosomes which determine sex: a female contains two X chromosomes and a male contains one X and one Y chromosome. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. An egg and a sperm unite to form a new individual. The fact that the human body is formed from cells that contain two copies of each chromosome—and therefore two copies of each gene—explains many features of human heredity, such as how variations that are hidden in one generation can be expressed in the next.

Tenets of Scientific Creationism (Henry M. Morris, 1980):

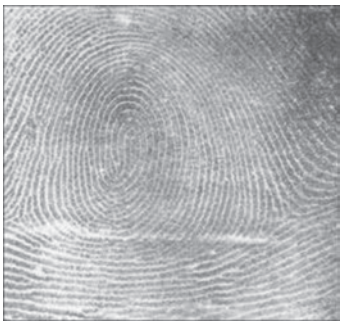
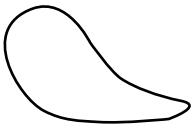
The phenomenon of biological life did not develop by natural processes from inanimate systems but was specially and supernaturally created by the Creator.

Fingerprint Genetics

Fingerprints are records of finger skin groove patterns. Each one is unique, yet their general patterns are inherited. They are the result of several different genes, and some of these genes may follow different inheritance patterns. Even though they harbor complicated details, common fingerprint shapes can be used to illustrate the Mendelian "dominance" inheritance pattern.

Problem: How are finger groove patterns inherited?

Analyze the information in the following chart.

Genotype	FF	Ff	ff
Genotype Condition	Homozygous Dominant	Heterozygous	Homozygous Recessive
Appearance			
Trait	Whorl	Loop	Arch
General Diagram			

Procedure:

Part 1: Obtaining Fingerprints

1. Trace an outline of your hand in the space provided.
2. Rub pencil "lead" to completely fill the square next to your hand tracing.
3. Roll your thumb on the square of pencil graphite. The graphite should fit into the tiny grooves of skin.
4. Transfer the graphite from your thumb to a piece of clear adhesive tape by placing the sticky side of the tape on the thumb's surface.
5. Put that tape, with its thumbprint, onto the end of the thumb you traced.
6. Repeat steps 3-5 for each of the other four fingers on that hand.

Part 2: Analyzing Fingerprints

1. By comparing your prints to the chart on the first page, determine which of the three general patterns best fits each fingerprint.
2. On each finger of the hand diagram, record the appropriate genotype below the taped fingerprints.

Fill in this square with pencil "lead."

Trace your hand in this box.

Discussion Questions:

1. Did every finger have the same genotype? _____

   Record the ratio of duplicate to unique genotypes from your and your partner's two fingerprinted hands.

   Number of duplicate genotypes on one hand: _____

   Number of unique genotypes on one hand: _____

2. After adding your personal ratio data to a large chart accessible to the class, record the ratio of duplicate to unique genotypes from the entire class.

   Number of duplicate genotypes on one hand (class data): _____

   Number of unique genotypes on one hand (class data): _____

   Describe any patterns that may be in this data.

   _____

   _____

   _____

3. Share notes with at least five other classmates, and survey which of their fingers had the same genotype and which were different. Based on this data, do all fingers generally have the same genotype?

   _____

   If not, which fingers usually shared the same genotype? _____

4. Choose one of your fingerprints and determine all the possible genotypes of your parents for that same finger.

   Name the finger chosen: _____

   Genotype of chosen finger: _____

   Possible genotypes of parents, assuming a dominant inheritance pattern:

   _____

   _____

   If possible, analyze your parents' and maybe even grandparents' fingerprints to see how closely you can determine the parent genotypes.

5. Describe the qualities of an algorithm or coded building instructions that would produce a pattern that was consistent and recognizable, yet would produce subtle differences every time it was used to build with. For example, would random gibberish work for such a code? Would a rigid, short code that produces perfect clones do the job?

_____

_____

_____

_____

6. What would it take to build such a code? Since our Creator actually did that when He made Adam and Eve, and since this code applies only to a tiny part of the human body, what does this say about the intelligence or other attributes of the Lord Jesus, who formed us and our fingerprints in our mothers' wombs?

_____

_____

_____

_____