A Trait Accompli: An Introduction to Mendelian Genetics

Mendelian Genetics

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Grade Level	9th – 12th Grade	**Time Frame**	4-5 class period(s)
Subject	Science	**Duration**	200 minutes
Course	Biology		

Essential Question

Why do organisms look the way they do?

Summary

Students will conduct a data-driven lab using common human phenotypes and present their findings to their peers in a Gallery Walk. Common genetic vocabulary will be researched by students and they will present their findings to the class. Students will connect common genetic themes with their earlier research on human phenotypes to draw conclusions about why organisms look the way they do.

Snapshot

Engage

Students will watch two short video clips about dominant and recessive genetic traits.

Explore

Students will conduct a phenotypic analysis lab of 13 common human characteristics using information collected from the class, including gender data.

Explain

Students will make calculations based on data from a lab and answer accompanying questions. They will explain their results in a Gallery Walk presentation.

Extend

Students will conduct Internet research on basic genetic terms/concepts. They will relate the terms to everyday examples and specifically to traits for which they collected data during the lab. They will then put the information into a PowerPoint presentation or Google Slides.

Evaluate

Students will present their research to the class using a slideshow or PowerPoint. Students not presenting will take notes for their notebooks for later reference. Teachers should add/subtract information as needed on particular areas.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD202: Identify basic features of a table, graph, or diagram (e.g., units of measurement)
IOD301: Select two or more pieces of data from a simple data presentation
IOD403: Translate information into a table, graph, or diagram
IOD404: Perform a simple interpolation or simple extrapolation using data in a table or graph
SIN201: Find basic information in text that describes a simple experiment
SIN301: Understand the methods used in a simple experiment
SIN401: Understand a simple experimental design
EMI201: Find basic information in a model (conceptual)
EMI301: Identify implications in a model
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text
EMI603: Use new information to make a prediction based on a model

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS3-3: Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

Oklahoma Academic Standards (Biology)

B.LS3.1 : Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

Attachments

- Graph Paper—A Trait Accompli.pdf
- Lab, Part A—A Trait Accompli - Spanish.docx
- Lab, Part A—A Trait Accompli - Spanish.pdf
- Lab, Part A—A Trait Accompli.docx
- Lab, Part A—A Trait Accompli.pdf
- Lab, Part B—A Trait Accompli - Spanish.pdf
- Lab, Part B—A Trait Accompli - Spanish.ppt
- Lab, Part B—A Trait Accompli.pdf
- Lab, Part B—A Trait Accompli.ppt
- Poster Project Student Handout—A Trait Accompli - Spanish.docx
- Poster Project Student Handout—A Trait Accompli - Spanish.pdf
- Poster Project Student Handout—A Trait Accompli-.docx
- Poster Project Student Handout—A Trait Accompli-.pdf
- Research Assignment Handout—A Trait Accompli - Spanish.docx
- Research Assignment Handout—A Trait Accompli - Spanish.pdf
- Research Assignment Handout—A Trait Accompli.docx
- Research Assignment Handout—A Trait Accompli.pdf
- Research Slideshow Template—A Trait Accompli - Spanish.pptx
- Research Slideshow Template—A Trait Accompli.pptx

Materials

- YouTube Video clip 1 (2 min): "Are Your Traits Dominant?"
- YouTube Video clip 2 (2 min): "How Special are Your Traits?"
- Overhead projector
- Laptop with "Lab, Part B" PowerPoint loaded and ready to project
- Lab, Part A handout with data table (attached)
- Genetic test strips for the tastes of PTC, thiourea, and sodium benzoate

- Completed data table for each student
- Poster Project Student Handout (attached; one per group)
- 2 sheets of graph paper per group
- Colored pencils for each group
- Scissors for each group
- Colored markers for each group
- Glue sticks or tape for each group
- Poster paper for each group
- Chromebook, laptop, or computer with Internet access for each person
- Research Assignment handout (attached; one per group)
- Research Slideshow Template (attached)
- Notebooks for each person

Engage

Pair students using the Appointment Clock Strategy. These pairs will also be kept together for the Explore portion of the lesson. Students will watch the two-minute video clip "Are Your Traits Dominant?" They will then watch a second two-minute video clip called "How Special Are Your Physical Traits?" These videos will introduce the Explore portion of the lesson.

Explore

Keep students in the same pairs as determined earlier in the lesson by the Appointment Clock. Each student should receive the "A Trait Accompli Lab, Part A" handout. The handout includes instructions for understanding traits that have been grouped as type A or type B along with a data table. Teachers should use the attached PowerPoint, "A Trait Accompli Lab, Part B," to present students with the essential question, which should be revisited several times throughout the lesson. The teacher should present each phenotypic trait in the slideshow, starting with earlobe attachment and ending with sodium benzoate taster. Teachers should pause between each trait and have students identify their phenotype and genotype possibilities. Partners will help each other decide their phenotypes as each trait is presented. Teachers should make a count of how many students have each trait type, A or B, and also record how many students of each gender have each trait type. It should take only about three minutes to cover each trait, with this activity taking about 40-45 minutes.

Teacher's Note

Teachers should not present any genetic terms or principles prior to the Explore activity. By the end of the lesson, students will be able to relate key genetic principles to the phenotypic traits and genotypes that were introduced in the opening lab. Teachers should progress through the slides for each trait so students can see what the trait is supposed to look like. For left/right thumb dominance, have students shake their hands vigorously at the wrist and suddenly clasp their hands together, interlocking their fingers. This is the easiest way to determine if the left or right thumb ends up on top. For the trait mid-digital hair, the hair can be very light in color, but will still count as being expressed if it is on the third through fifth digits on the middle joints. The PTC and thiourea tasting strips are acridly bitter, so it is a good idea to have trash cans handy. Pass out all three taste strips before you have students test the first strip, so the eager achievers will not reveal information to the rest of the class before everyone has a chance to conduct the tests. If possible, figure out a way to have the taste papers passed out before the lab even starts, to save time.

Test Strip Information

Test strips can be bought through biological supply companies. It is a good idea to check company websites for shipping times and to consider how much time is necessary to clear purchase orders at your school. The current cost at Carolina Biological is $4.25, for a pack of 100 control strips (item 174000); $4.25 for a pack of 100 thiourea strips (item 174030); $4.25 for a pack of 100 sodium benzoate strips (item 174020); and $4.25 for a pack of 100 PTC strips (item 174010). These strips can last several years if kept in a plastic bag between uses. Strips can be cut in half or thirds and still provide accurate results. If cut in thirds, a pack of 100 would allow 300 uses, making them quite economical. However, the lab does not suffer if you decide to not include the test/taste strips.

Explain

Student pairs will calculate the data from the Explore portion of the lesson. Once all data is collected, students will begin calculating percentages for the traits of the class and for the traits separated out by gender. Student pairs will graph the data and use it to answer a set of analysis questions. Directions for the graphing and questions to be answered are included in the handout "A Trait Accompli, Part A." Results will be presented on poster paper and students will use a Gallery Walk to present their findings. Students will look over the findings of the other pairs to see if they are similar, and add one comment to the essential question at the bottom of each poster presentation. This portion of the activity should take approximately 50 to 75 minutes.

Teacher's Note

Display the posters around the room or down a hallway. Beginning in front of their own posters, students will then conduct a Gallery Walk. Give students a couple of minutes to observe each poster before moving to the next one. Students will place a self-stick note with a positive or negative comment about the results on each of the posters. Each pair should place a second comment on a self-stick note next to the essential question of the lesson, number 10. They may agree with the other teams, disagree, or offer their own answers on the other students' posters.

Extend

The teacher should pair students with new partners using the Appointment Clock strategy and assign each pair to a research group. Use the attached **Research Assignment** handout which provides group numbers and research topics. The teacher can make available the attached **Research Slideshow Template** to students, or the pairs can create their own slides from scratch, using the information provided in the "Research Assignment Handout." Each pair will create one slideshow containing four slides. This portion of the lesson will last approximately 25-30 minutes.

Teacher's Note

Teachers may copy the attached slideshow template into Google Classroom for students to access, or students can use Google Slides that they will then share with the teacher. The lesson provides six research topics. Teachers may add to the research topics and create more groups, or they may assign some student pairs to the same research topic. For this lesson, groups larger than two students are not recommended. The research and presentation of the information is intended to push students into learning new material and connecting past labs and activities to their new knowledge. Groups of two allow the lesson to progress faster and facilitates peer collaboration in accessing the new knowledge. Larger groups could interfere with both the pacing of the lesson and collaboration.

Evaluate

Students will present the research to the class on an overhead, proceeding consecutively, with all pairs assigned topic one presenting first, followed by those working on research topic two, and continuing until all students have presented. Students will take notes on the information presented and ask questions as the lesson progresses. The "Research Assignment Handout" provides a template of the slideshow expectations alongside an example of how student notes might start and end with the essential question. Students will use their research to expand on past knowledge and answer the essential question. This portion of the lesson will take approximately 50 minutes.

Teacher's Note

Teachers may want to inform students that if a group presenting on a research topic says the same thing or something similar to a previous group, it is not necessary take the same notes twice. Only new information or information that clarifies a point needs to be included in students' notes.

Resources

- K20 Center. (n.d.). Appointment clock. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505c91e
- BuzzFeedBlue. (2014, May 23). "Are your traits dominant?" [Video file]. Retrieved from https://www.youtube.com/watch?v=mnSkz8s-b44
- BuzzFeedVideo. (2013, April 23). "How special are your physical traits?" [Video file]. Retrieved from https://www.youtube.com/watch?v=9SdCoNpDzqw
- K20 Center. (n.d.). Gallery walk/Carousel. Strategies. https://learn.k20center.ou.edu/strategy/d9908066f654727934df7bf4f505a54d
- K20 Center. (n.d.). Google classroom. Tech Tools. https://learn.k20center.ou.edu/tech-tool/628