Genetics – Horns Dilemma

Teacher's Guide

1.0 Summary

The *Horns Dilemma* is an extension of the *Genetics* Core curriculum. It may be used as an enrichment activity for students who are looking for a challenge. It can serve as reinforcement or as an assessment of their work in Rules and Meiosis.

Most students complete the *Horns Dilemma* activity in 15 minutes.

2.0 Learning Goals

Driving Question: Can two horned parents have a hornless baby?

This activity challenges the students to use the knowledge gained in the previous activities to solve a puzzle. Students work to produce a hornless dragon from two parents who each have horns.

Learning Goals

- Students will understand the terms heterozygous and homozygous.
- Students will know that an individual trait can be heterozygous, homozygous dominant or homozygous recessive.
- Students will learn that two parents can pass on a trait that they do not have because they are both heterozygous for that particular trait.
- Students will demonstrate their understanding by creating offspring with a recessive trait.

Additional Teacher Background

This activity is a quick method of reinforcing and applying the Rules of Inheritance. For quick reference, a printed copy of the Dragon Genome Chart is always helpful.

Cystic Fibrosis is a recessive hereditary disease that affects the respiratory system. Most genetic disorders are recessive; therefore, a person must inherit two defective genes, one from each parent in order to have the disease. The parents may not in fact know that they have mutated gene because they do not have the disorder; they have only one allele for the disease. Other recessive disorders are, Tay-Sach's disease, albinism, PKU, and nearsightedness.

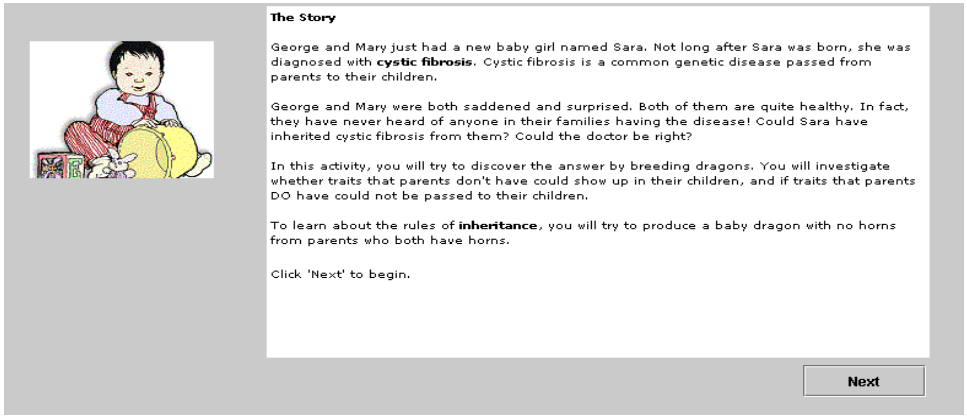
3.0 Standards Alignment

Alignment to National Math and Science Standards (NCTM or NSES)

Objective	Standards
Students will engage in multilevel thinking.	• Students should develop the ability to move among three domains of thought.
Students will exercise effect-to-cause and cause-to-effect reasoning.	• Students should base their explanation on what they observed, and as they develop cognitive skills, they should be able to differentiate explanation from description--providing causes for effects.
Students will demonstrate knowledge of the inheritance of recessive traits.	• Students will know that hereditary information is contained in genes, located in the chromosomes of each cell.
Students will recognize that each offspring inherits 1/2 of its genes from each of its parents.	• Students should recognize that the transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. • Students should understand that an egg and a sperm unite to form a new individual. • Students should understand 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.

4.0 Activity Sections

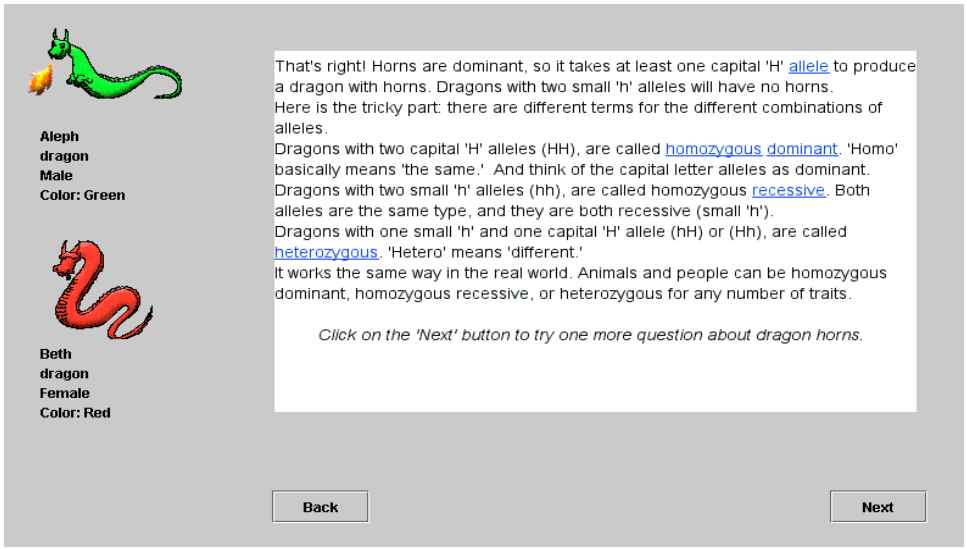
In this activity students use what they have learned about the rules of inheritance, specifically, how recessive traits pass to offspring from parents who display a dominant trait. A child can have the genetic illness, Cystic Fibrosis, even if his/her parents do not, because it is a recessive trait.



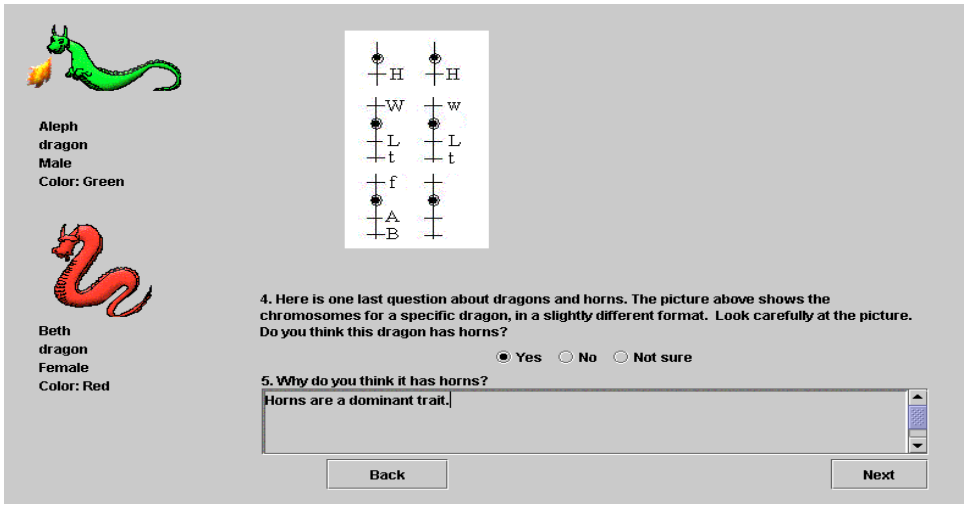
Introduction

4.1 Review Horns Rule

Step 1: Recall, are horns a dominant or recessive trait? (Dominant)
Step 2: Answer the question and provide an explanation.



Review of heterozygous and homozygous

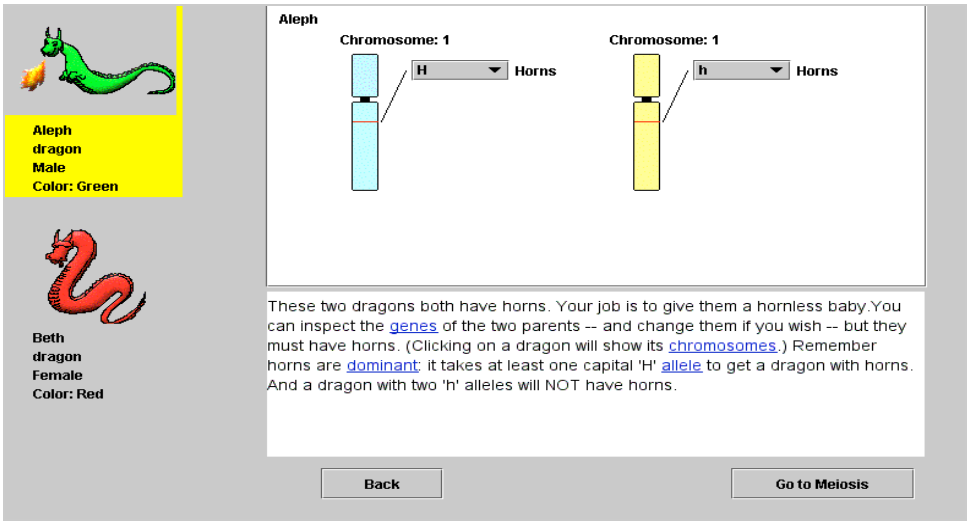


Horns are a dominant trait.

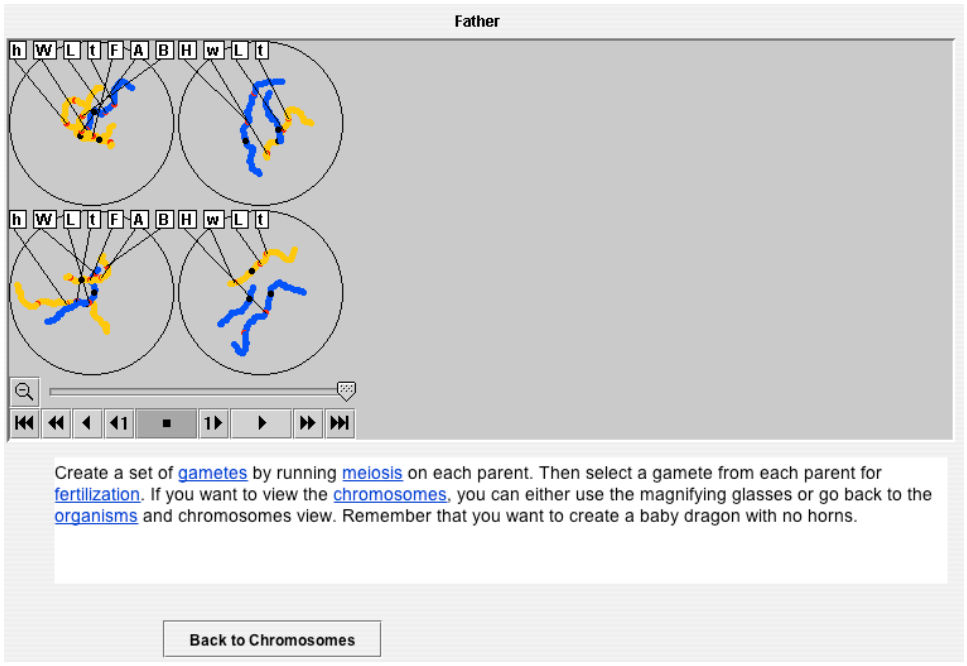
4.2 Solve the Puzzle

Students must:

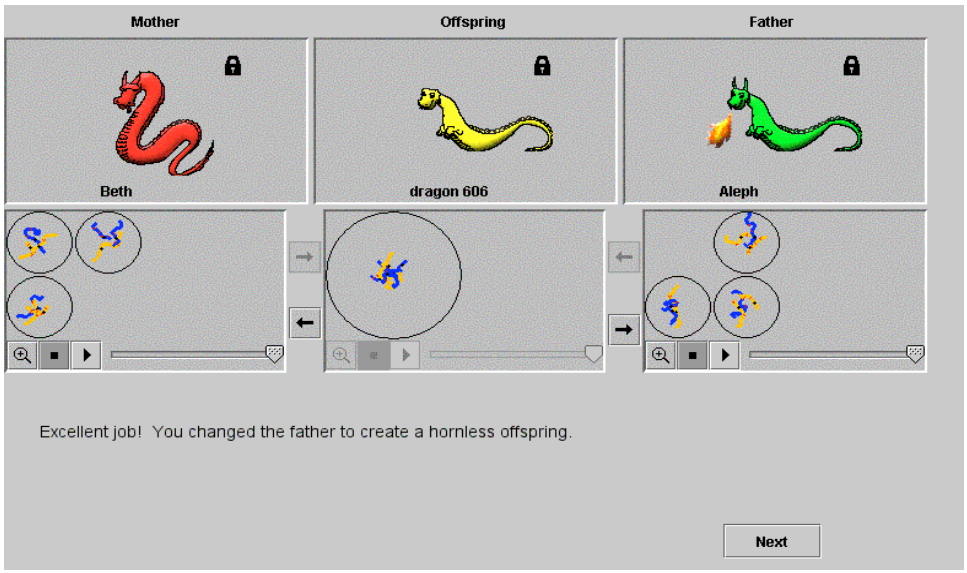
- check the parents' alleles,
- figure out that they have to change Aleph's allele for Horns to heterozygous,
- run meiosis,
- select gametes with the 'h' allele, and
- run fertlization.



Using the pull down menus, change Aleph's Horns alleles to Hh.



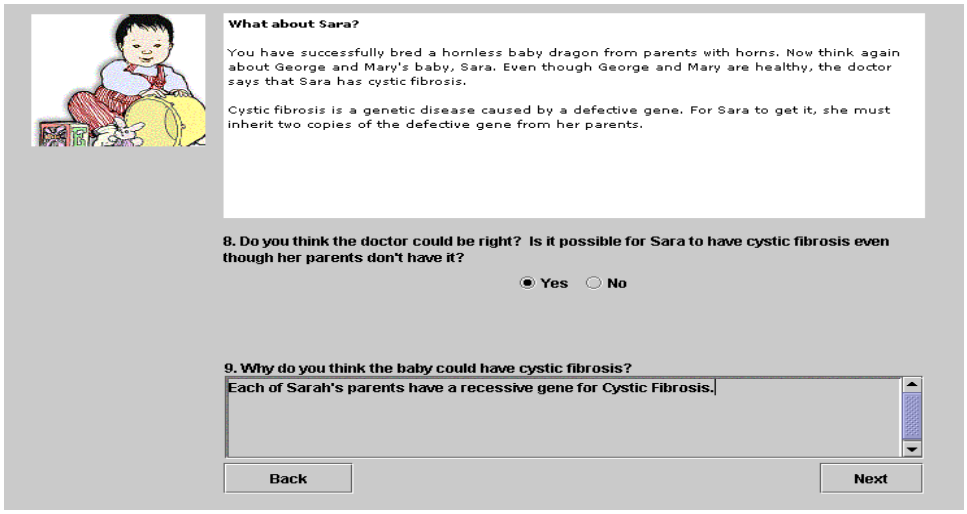
Select gametes with 'h' allele.



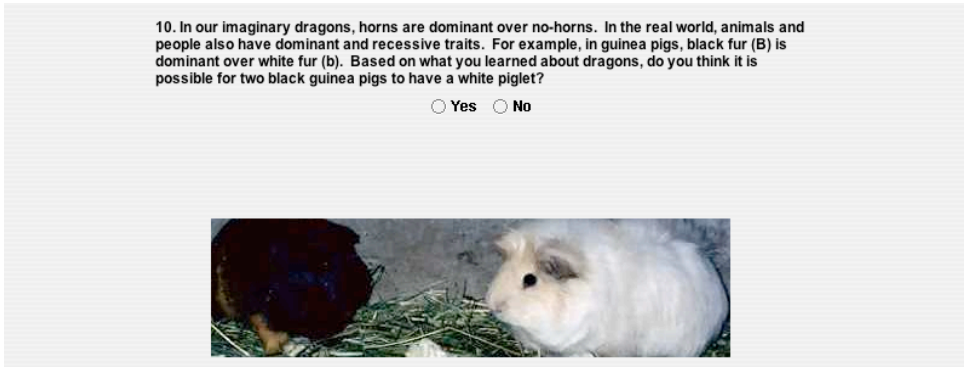
Run fertilization to produce a "Hornless" dragon.

4.3 Real World Application

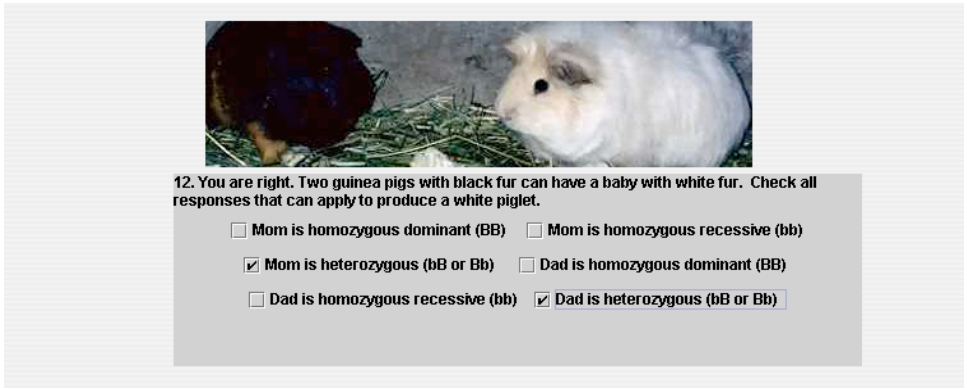
In this section, students learn how the recessive allele situation applies to real life. Also included are examples of a dominant trait in animal parents, producing a recessive trait in their offspring.



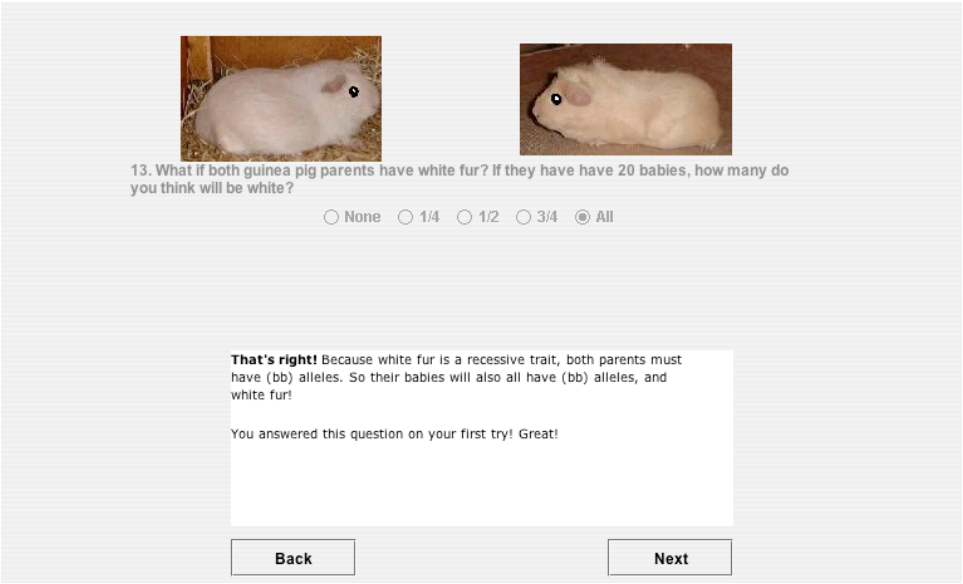
Yes, this can also happen in humans.



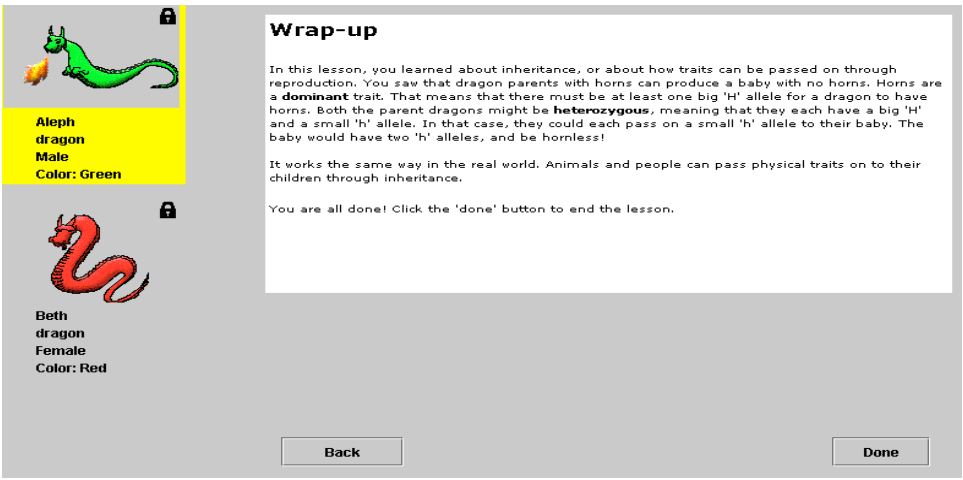
Guinea pig question (1)



Guinea pig question (2)



Guinea pig question (3)



Summary

5.0 Student Reports

Your students' work with Horns Dilemma is logged and viewable on the MAC Project Web Portal at http://mac.concord.org. For each student, you can view a report containing questions and answers.

If students successfully create a hornless dragon without assistance from peers or teacher, it is considered evidence that they have a good model of meiosis and fertilization. Students are now well prepared for core activities *Monohybrid* and beyond.