Genetics – Plates

Teacher's Guide

1.0 Summary

Plates, is an extension activity designed to challenge student knowledge about previously learned *Genetics* concepts. Most students complete this activity in approximately 10-15 minutes.

2.0 Learning Goals

Driving Question: How are plates inherited?

This activity is similar to Scales, but this trait is x-linked and incompletely dominant. The students must determine the inheritance pattern of this new trait and the location of its gene by approximating the reasoning processes of professional geneticists.

Learning Goals

- Students will demonstrate their understanding of x-linked traits.
- Students will demonstrate their understanding of incomplete dominance.
- Students will complete and analyze Punnett Squares to determine the probability of the Plates traits in offspring.
- Students will analyze results of parental crosses for Plates to determine the pattern of inheritance for that trait.

Additional Teacher Background

The emphasis of this activity reviews two key concepts. The first, incomplete dominance, explores the interactions between alleles in which neither allele is fully expressed. Secondly, the students discover that the pattern of inheritance for Plates genes, which are sex-linked, and are part of the X chromosome.

Students can access a glossary of genetic terminology by clicking on the *Glossary* button located in the upper, left-hand corner of the screen. Also, students can use the Glossary tool as a means of review. Students can view the list and discover: a) terms they should now know, and b) terms they realize they have not yet grasped. This is a good opportunity for students perhaps to make a list or flash cards of unfamiliar terms before the final test.

The Genome code for Plates is as follows: PP =big plates, Pp= small plates, and pp, represent no plates.
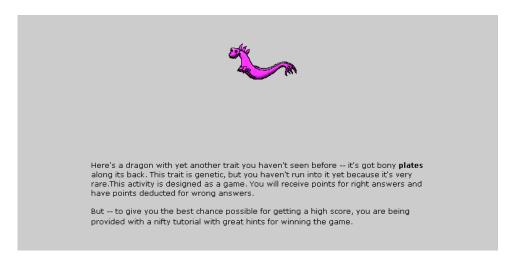
3.0 Standards Alignment

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

Objective	Standards
Students will get further practice in using statistics to determine inheritance patterns.	Students should learn how to analyze evidence and data.
Students will practice the strategies for investigating a new trait.	Students should demonstrate appropriate procedures, a knowledge base, and a conceptual understanding of scientific investigations.
Students will practice using inductive reasoning to solve a puzzle.	Students will focus on questions that can be answered by using observational data, the knowledge base of science, and processes of reasoning.

4.0 Activity Section

The *Plates* activity allows students to utilize the knowledge they have acquired throughout the *Genetics* model. In particular, *Plates* revisits the concepts of x-linkage and incomplete dominance.

Here's a dragon with yet another trait you haven't seen before -- it's got bony **plates** along its back. This trait is genetic, but you haven't run into it yet because it's very rare.This activity is designed as a game. You will receive points for right answers and have points deducted for wrong answers.

But -- to give you the best chance possible for getting a high score, you are being provided with a nifty tutorial with great hints for winning the game.

Introduction

4.1 Review of Incomplete Dominance

File   Glossary

1. Remember legs? Two alleles were responsible for 3 versions of the trait-LL, 4 legs; Ll, 2 legs; ll, no legs. Look at this pedigree. Looks a little like the one for legs, right? How many versions of the trait are represented here?

○ One   ○ Two   ● Three

2. How many alleles do you think there are for this trait?

○ One   ○ Two   ○ Three

3. Explain:

Next

Review the traits for legs.

4.2 Investigation of New Trait

File   Glossary

Plates   Number of Offspring: 40

No Plates   Little Plates   Big Plates

Now you will want to find out whether the trait is sex_linked or autosomal. Again, breed the dragon with plates with another dragon. Then cross two dragons with small plates to get the F2 generation. From the resulting offspring see if you can figure it out.

Add male   Add female   Next

Add another male dragon and cross with the original female to examine the pattern.

Plates ▾   Number of Offspring: 120
○☐ No Plates   ◉◪ Little Plates   ◉■ Big Plates

Now you will want to find out whether the trait is sex_linked or autosomal. Again, breed the dragon with plates with another dragon. Then cross two dragons with small plates to get the F2 generation. From the resulting offspring see if you can figure it out.

Add male   Add female   Next

Use the Cross tool to breed 2 dragons with small plates to produce F2 generation.

4.3 Compare Punnett Squares for Autosomal and Sex-Linked Traits

File   Glossary

	p	-
P	Pp	P-
p	pp	p-

7. Now think about what would happen if the trait were sex-linked. What chromosome (in dragons) carries the gene in sex-linked traits?

◉ The X chromosome
○ The Y chromosome

Fill in the Punnett square. Now, what about the F2 generation?

Next

Complete a series of Punnett Squares.

| Plates ▼ | | Number of Offspring: 120 |

○☐ No Plates   ◐◪ Little Plates   ●■ Big Plates

F1   F1

F2

Using the F2 generation:

15. Count the number of males with big plates `0`   , with little plates `7`   with no plates `13`   .

16. Count the number of females with big plates `9`   ,with little plates `10`   , and with no plates `0`   .

17. Now answer the question, is this trait

○ autosomal   ○ sex-linked

Analyze the distribution of traits for the F2 generation and study the key. Answer the questions when you figure it out. Plates are a sex-linked, incompletely dominant trait.

4.4 Rules of The Game

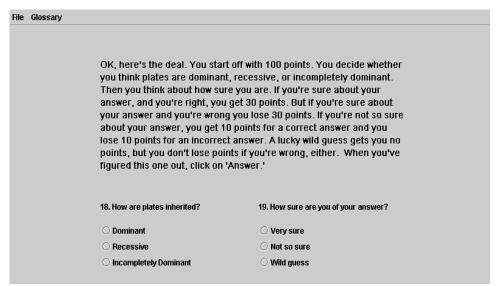OK, here's the deal. You start off with 100 points. You decide whether you think plates are dominant, recessive, or incompletely dominant. Then you think about how sure you are. If you're sure about your answer, and you're right, you get 30 points. But if you're sure about your answer and you're wrong you lose 30 points. If you're not so sure about your answer, you get 10 points for a correct answer and you lose 10 points for an incorrect answer. A lucky wild guess gets you no points, but you don't lose points if you're wrong, either. When you've figured this one out, click on 'Answer.'

18. How are plates inherited?

○ Dominant

○ Recessive

○ Incompletely Dominant

19. How sure are you of your answer?

○ Very sure

○ Not so sure

○ Wild guess

Answer a series of questions to "win" points

File   Glossary

(1) Plates have to be incompletely dominant because there are three distinct phenotypes: big plates, small plates, and no plates at all. Any time a single gene gives rise to three possibilities it has to be incompletely dominant.

(2) The question of what chromosome the gene is on is a little harder. The clue is that you never see males with big plates. Females can have big plates, small plates, or no plates; males can only have small plates or none. This automatically means that the plates gene must be on a sex chromosome (otherwise it would treat the two sexes the same). If it were on the Y chromosome females could never have plates, since they don't have a Y. So it must be on the X chromosome, meaning that males can only get one copy (which gives them small plates) while females can get either one copy (small plates) or two (big plates).

Summary

5.0 Student Reports

Your students' work with Plates 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.