Genetics Introduction

Teacher's Guide

1.0 Summary

The *Introduction* activity should follow the Pre-test.

The *Introduction* activity allows the students to develop a familiarity with the software as well as with the basic concepts of genetics. The projected time to complete this activity is, at most, one class period of 45-50 minutes. Many students finish in less time. You may want to include a 10-minute analysis and "Wrapping Up" discussion.

2.0 Learning Goals

Driving Question: What do dragons look like and why?

This activity guides learners through BioLogica's Chromosome Model and its representations of chromosomes, genes and alleles. It stresses the connection between genotype and phenotype. As learners use pull down menus in the Chromosome Model to change allele combinations, the Organism Model shows them the changes in the dragons.

It is highly recommended that students take advantage of these activities in order to establish a basic working vocabulary and to learn how to navigate within the program.

Step One: Welcome to the world of BioLogica dragons.

Step Two: Students become acquainted with dragon characteristics. First, students describe the particular traits of one dragon. The following screen requires several clicks in order to accumulate a variety of dragons. Students will then describe differences among dragon traits. Finally, students answer a question that is looking for a causal relationship for the variations among the dragons.

Step Three: Students become acquainted with the Chromosome model and related vocabulary words. To find the definition of a new term, they need only to click on the highlighted word. Students will note the differences between male and female chromosomes.

Step Four: Students manipulate the dragon chromosomes in order to change the alleles and traits of dragons in order to introduce the concept that genotype determines phenotype. Students experience the impact of dominant and recessive alleles on traits.

Learning Goals

- Students will learn to use the software.
- Students will make changes in the Chromosome Model.
- Students will relate basic genetic vocabulary with the concepts presented in the introduction.

- Students will make connections between the physical traits of each dragon and the genetic make-up of each dragon, and will also identify particular chromosomes, genes, and alleles.
- Students will identify male and female sex chromosomes.
- Students will learn that specific combinations of alleles produce specific traits.
- Students will learn that some combinations of alleles are deadly.
- Students will discover that genotype determines phenotype.

Additional Teacher Background

Genetics is the scientific study of heredity. Heredity, the transmission of characteristics from parent to offspring, is complex and produces many variations within a species.

All living things have unique characteristics know as traits. Chromosomes are threadlike structures within the nucleus that contain all of the genetic information needed to produce each trait. Genes passed from one generation to the next determine these traits. Genes are written in molecular code in a molecule known as DNA. The DNA of an individual organism comes directly from its parents: half from one parent, half from the other.

Every species has a particular number of chromosomes. For example, humans have 46 and dogs have 78. The number of chromosomes and the arrangement of the genes within those chromosomes determine the species and the characteristics of individual organisms within the species. The combination of an organism's alleles is its genotype. Specific combinations of alleles produce specific traits such as variations in eye, skin, and hair color.

The genotype is the genetic make-up of an organism. For example, the genotype for a blue-eyed baby is bb. The physical traits of an organism are known as its phenotype. This baby's phenotype is blue eyes for the genotype bb. Therefore, organisms' phenotypes (such as hair, skin, or eye color) are the physical attributes determined by their genotypes.

3.0 Standards Alignment

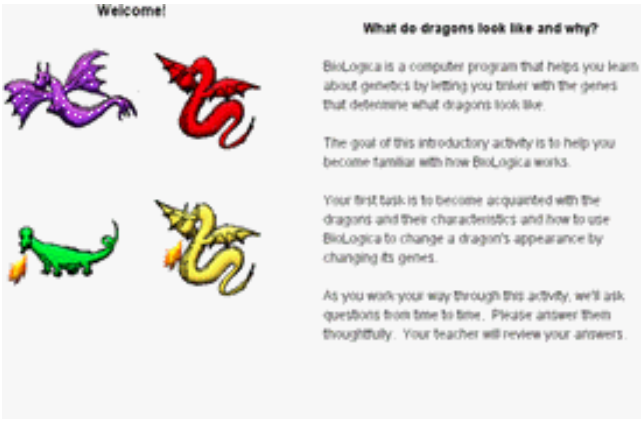
Alignment to National Math and Science Standards (NCTM or NSES)

Objective	Standards
The student will learn to use the software, notably to make changes in the Chromosome Model that cause changes in the phenotype in the Organism Model.	Students will use technology to improve investigations.
The student will learn that genotype determines phenotype.	Students will know that the characteristics of an organism can be described in terms of a combination of traits.
Students will link representations in the model with genetics, chromosomes, genes and alleles.	Students will expand their understanding of biology by incorporating more knowledge that is abstract.

4.0 Activity Sections

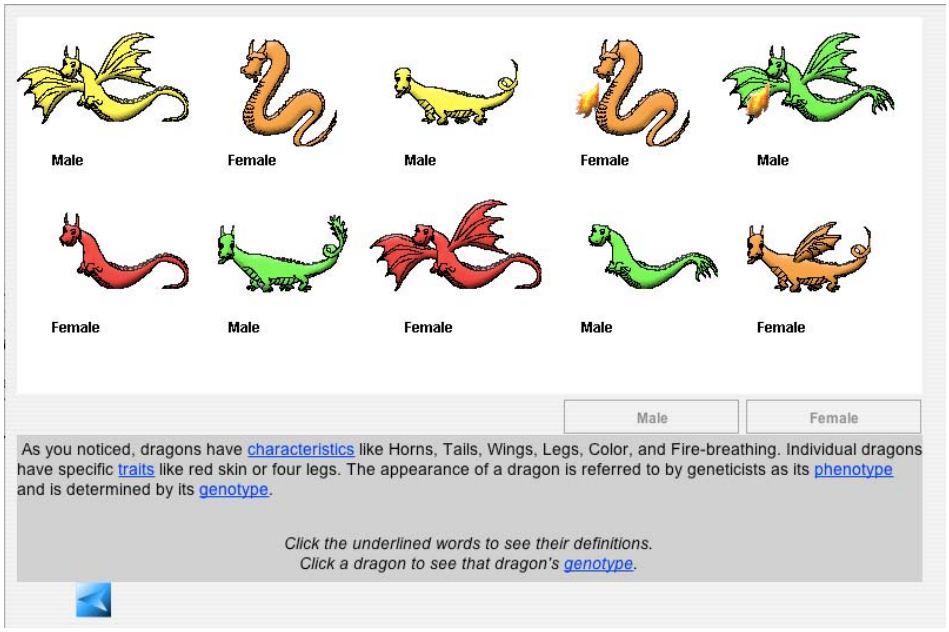
4.1 Getting Started

Introduction contains approximately 38 screens**.** The first screen outlines the goals of the activity and the idea of variation amongst dragons.



4.2

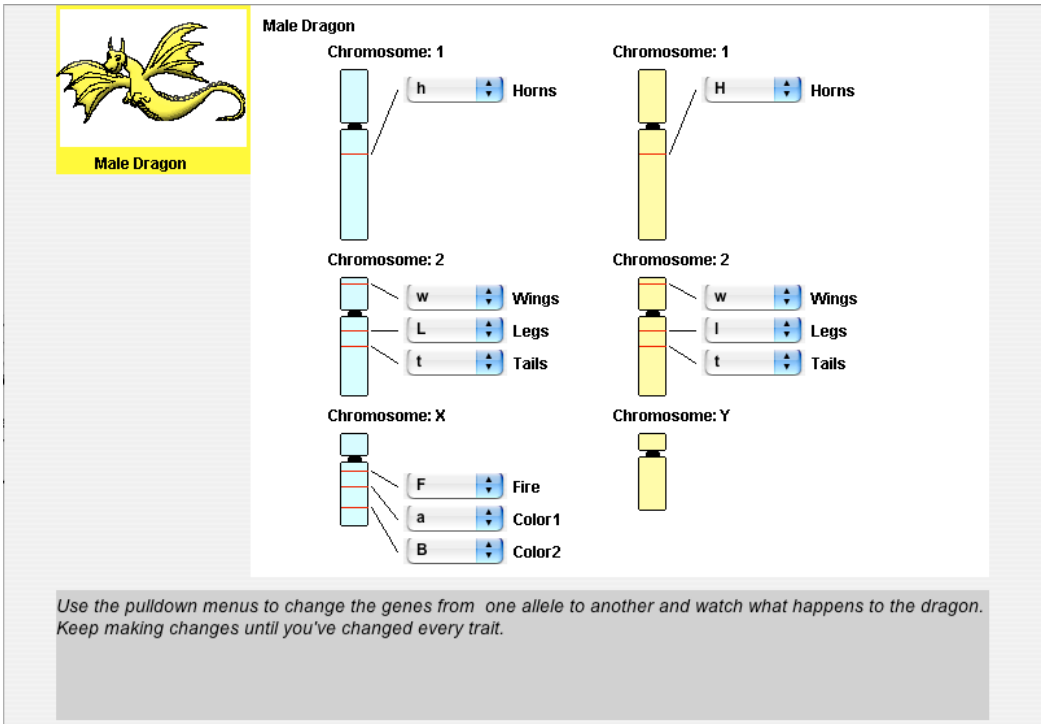
In the first section (approximately 8 screens), students explore the phenotypes of dragons while learning to use the BioLogica interface. This section involves simple tasks such as selecting male and female dragons through a click of the mouse. Students are asked to describe the variations amongst a set of dragons and what they believe causes these differences. Vocabulary is introduced as needed through definitions that pop-up when underlined words are clicked.



NOTE: Students must click on a dragon in order to obtain a genotype and move to the next section.

4.3

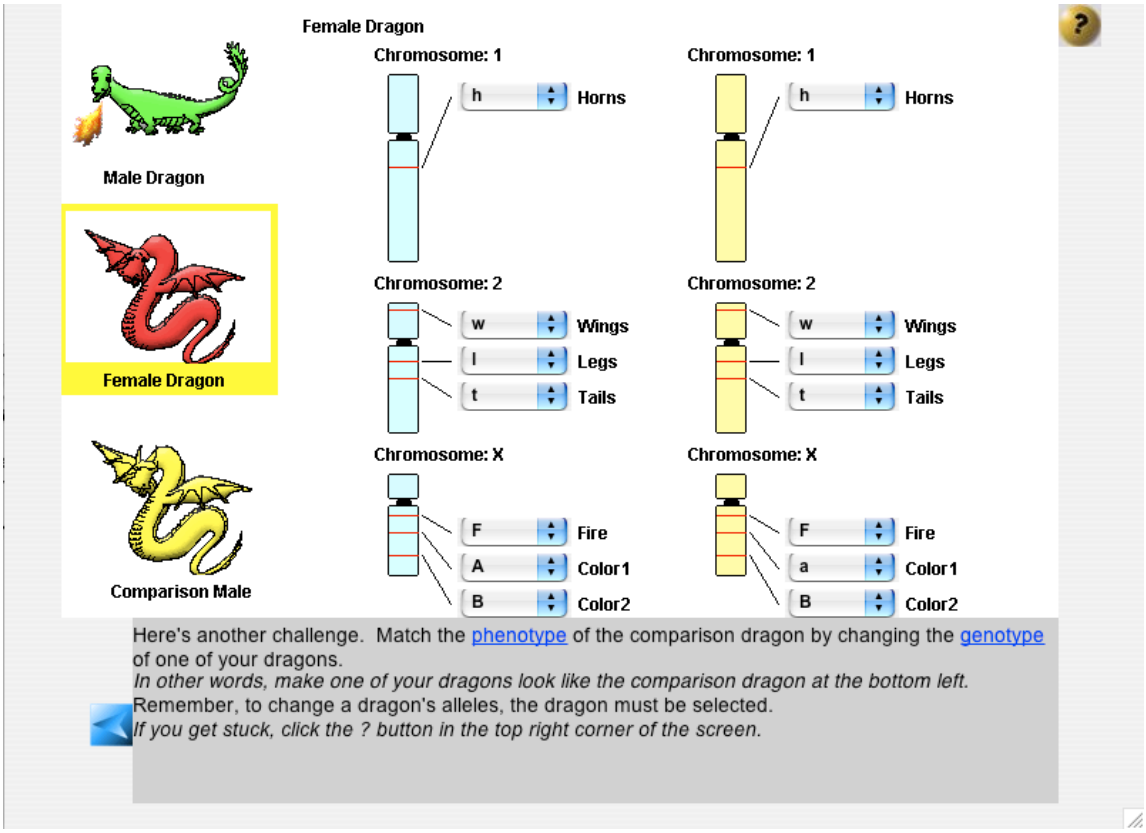
In this section, students experiment with the 3 pairs of chromosomes that make up the dragon genome. They change the traits of the dragons by using a pull down menu for each allele. The students continue through a series of explorations and answer questions related to their understanding of each task. If the student does not answer correctly, he/she can practice until he/she understands.



Note: In this first exploration students must change every trait in order to proceed. If they appear to be stuck, the text at the bottom tells them which gene and trait remains to be changed.

Dragon Genome Chart	
Horns are dominant to no horns.	HH or Hh = horns hh = no horns
Wings are recessive to no wings.	WW or Ww = no wings ww = wings
Legs are incompletely dominant.	LL = 4 legs Ll = 2 legs ll = no legs
Fancy tails are dominant to plain tails.	TT or Tt = fancy tail tt = plain tail
Fire-breathing is recessive to non-fire-breathing and is an X-linked characteristic.	Males: F— = non-fire-breathing males f— = fire-breathing males Females: FF, Ff = non- fire-breathing females ff = fire-breathing females
Color is a polygenic, X-linked characteristic.	Males: Green A-B- Yellow a-B- Females: Red AABB or AaBB Blue aaBb Brown AABb or AaBb Purple aaBB

In this section, students are given three challenges that build on the previous exploration of the dragon genome; they must make a dragon with no legs, match a dragon that is identified as either male or female, and match a dragon whose gender is not identified.



Note: You must click on a dragon to change its alleles. You can't match a male and female dragon because the two Color genes are on the X chromosome.

The activity ends with 5 quiz questions followed by a summary. The answers are: 15. phenotype, 16. genotype, 17. A, 18. Female, 19. Male

5.0 Student Reports

Your students' work with *Introduction* 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.

The next activity that students should use is *Rules*, which focuses on dominance relationships among alleles.