Pigeonetics Game

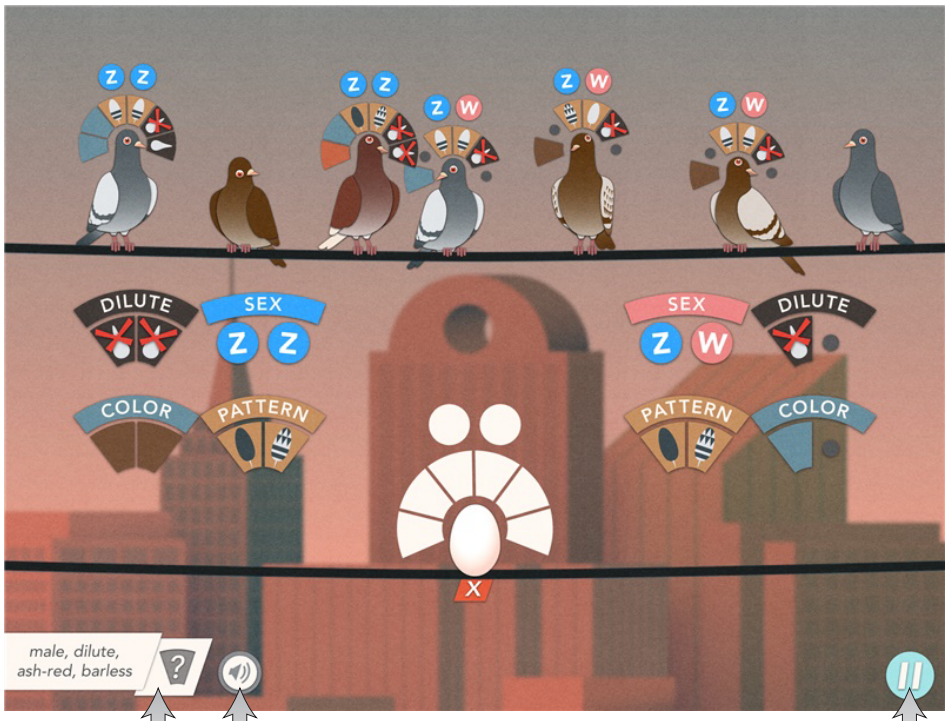
Teacher Guide

Breed pigeons for desired traits while learning the basic laws of inheritance.
Choose pigeons with the right genotype, and breed them to yield offspring with a specified phenotype in 26 puzzles of increasing complexity.

Best Browsers: Most recent versions of modern browsers

(Note: Hitting the back arrow in the browser will navigate you out of the game. To navigate forward and back through the game, use the arrows at the top and bottom of the game screen)

Features:



Next to the target bird phenotype, the "allele key" button reveals a key to the allele icons used in that puzzle

Mute Button: mutes all sounds and automatically turns on closed captioning

The "pause" button opens a menu with the following controls:

- **Turn sound effects and music off and on**
- **Track progress through the game's levels**
- **See scores of completed levels**
- **Select specific levels to play**
- **Reset the game**

"Learn More" buttons at the end of some puzzles link to web pages in the Pigeon Breeding: Genetics at Work module. These pages have additional information about characteristics, inheritance patterns, and the molecular mechanisms connecting DNA to traits.

Golden eggs track the user's score. Win more eggs for solving the puzzle in fewer steps. Perfect scores are rewarded with three golden eggs.

"Explain" buttons at the end of some puzzles reveal information about characteristics and inheritance patterns. Encourage students to explore this content—it may help them solve future puzzles.

Closed captioning button

A note about nomenclature
Sometimes, phenotypes, genes, and alleles have the same names. To keep them straight, we've tried to use the following conventions:

Phenotypes are in plain text: crest

Gene names are italicized: *crest*

Allele names are in single quotes: 'crest'

Ideas for Classroom Implementation:
Have students work individually or in pairs through the puzzles. Be sure to have students reset the game (option in the pause menu) to clear their progress before the next class begins.

Project and work through puzzles as a class. If you wish to demonstrate only certain inheritance patterns, use the pause menu to play only the levels of interest. Inheritance patterns are indicated in the guide below.

Hint for struggling students: It helps to keep track of the alleles, inheritance patterns, and dominance hierarchy for each gene on a separate sheet of paper as you progress. For example, crest is a recessive phenotype that requires two 'crest' alleles. Before they begin a puzzle, encourage students to think about the allele combination (genotype) that will yield the desired phenotype.

A note about gameplay

Pigeonetics is a game, and students will need to use logic strategies to solve the puzzles.

The pool of parents presented at the beginning of each puzzle includes all of the alleles required to solve that puzzle.

Parents not selected for the first breeding will be available for subsequent steps.

For puzzles involving multiple breeding steps, students should strategically choose the sex of the intermediate offspring—it may be different than the target.

Later in the game, the option to add another pigeon in a single generation is introduced, and is sometimes necessary for completing the puzzle.

Puzzle Guide:

This guide is provided as a roadmap of the puzzles and concepts introduced in Pigeonetics. It contains key information that will help you solve the puzzles, but without explicitly giving away the answers (in case it ends up in the hands of your students).

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
1	Female	Sex is determined by two chromosomes	Choose the correct chromosomes.	
2	Male	Autosomal dominant: 'No crest' allele is dominant to 'crest' allele	Choose the correct chromosomes.	
3	Male, No crest	Autosomal recessive: Crest phenotype requires two copies of the 'crest' allele	Choose correct sex chromosomes and 'crest' alleles	Explain: Independent assortment. Sex and crest are inherited separately. Learn More link: Independent assortment and probability
4	Male, Crest	Autosomal recessive: Crest phenotype requires two copies of the 'crest' allele	Choose correct sex chromosomes and 'crest' alleles	Explain: Meaning of dominant and recessive Learn More link: Crest (includes information about DNA to trait)

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
5	Female, Crest		Two steps: 1.Create a female with one ‘crest’ allele. 2.Breed. Choose correct sex chromosomes and alleles.	
6	Male, No foot feathers	Partial Dominance: heterozygotes (one of each allele) have an intermediate phenotype	Two steps: 1.Create a male with one ‘no slipper’ allele. 2. Breed. Choose correct sex chromosomes and alleles.	Explain: Meaning of partial dominance
7	Female, Slipper, Crest		Two Steps: 1.Create a male with one 'slipper' and one 'crest' allele. 2. Breed. Choose correct sex chromosomes and alleles.	Explain: Independent assortment and probability
8	Male, Slipper, Grouse	'Grouse' is recessive to 'not grouse' Together, Grouse and Slipper make the muff phenotype.	Two Steps using Add Another: 1. Create a female with one copy each of the ‘grouse’ and ‘slipper’ alleles. Choose Add Another to produce a male with the same allele combination. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	Explain: Genes work together to make a range of foot-feathering phenotypes
9	Female, Bar	Dominant/recessive: 'bar' allele is recessive to 'check' allele	Two Steps using Add Another: 1. Create a male and female, each with a ‘bar’ allele. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	Explain: Dominance hierarchy of pattern alleles; dominant and recessive are relative terms

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
10	Male, Barless	Dominant/recessive: 'barless' allele is recessive to 't-check' allele	Two Steps using Add Another: 1. Create a male and female, each with a 'barless' allele. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	
11	Female, Bar	Hierarchy of Dominance: One pattern gene with 4 alleles. Order of most to least dominant: 't-check,' 'check,' 'bar,' 'barless'	One step: Choose correct sex chromosomes and wing pattern alleles.	
12	Female, Barless, Crest		Two Steps: 1. Create a female with at least one 'barless' and 'crest' allele. 2. Breed. Choose correct sex chromosomes and alleles.	
13	Male, Blue	Sex-linkage: Color gene is on the Z chromosome Color alleles have a hierarchy of dominance. Order of most to least dominant: 'ash red,' 'blue,' 'brown'	One step: Choose correct sex chromosomes and wing pattern alleles.	Explain: Inheritance of sex-linked genes
14	Male, Brown, T-check		Two Steps: 1. Create a male with at least one 't-check' and 'brown' allele. 2. Breed. Choose correct sex chromosomes and alleles.	Explain: color alleles have a hierarchy of dominance Learn More link: Major Color Locus (includes information about DNA to trait)

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
15	Male, Blue, Bar	Autosomal dominance: 'Spread' allele is dominant to 'not spread' Epistasis: Spread phenotype hides underlying wing pattern	Two Steps with Add Another: 1. Create a male and female with at least one 'no spread' and 'blue' allele. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	Explain: Inheritance patterns for spread Learn More link: Epistasis
16	Female, Brown, Check		Three Steps: 1. Create a male with at least one 'no spread' allele and at least one wing pattern allele that is recessive to 't-check'. 2. Create a male with at least one 'no spread' allele and one 'check' allele. 3. Breed. Choose correct sex chromosomes and alleles.	
17	Female, Spread, Ash-red		Two Steps: 1. Create a male with at least one 'ash red' allele. 2. Breed. Choose correct sex chromosomes and alleles.	
18	Male, Ash-red, Bar		Two Steps with Add Another: 1. Create a male with at least one each of 'no spread,' 'ash red,' and 'bar' alleles. Create a female with at least one each of 'no spread' and 'bar' alleles. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
19	Female, Crest, Recessive Red	Autosomal recessive: 'Recessive red' allele is recessive to 'not recessive red' Epistasis: Recessive red phenotype masks output of color, pattern, and spread genes	Two Steps with Add Another: 1. Create a male and female each with at least one copy of the 'crest' and 'recessive red' alleles. 2. Breed. Choose correct sex chromosomes and alleles.	Explain: Recessive red inheritance pattern and epistatic relationships Learn More link: Recessive Red (includes information about DNA to trait)
20	Female, Slipper, Recessive Red, Grouse		Two Steps with Add Another: 1. Create a male and female, each with at least one 'slipper,' 'recessive red,' and 'grouse' allele. 2. Breed the two offspring. Choose correct sex chromosomes and alleles.	
21	Male, Blue, Spread		Four Steps: 1. Create a male with at least one 'blue' allele. 2. Create a male with at least one 'blue' and 'spread' allele. 3. Create a male with at least one 'blue,' 'spread,' and 'not recessive red' allele. 4.Breed. Choose correct sex chromosomes and alleles.	
22	Female, Ash-red, Spread, Crest		Three Steps: 1. Crete a female with at least one 'ash-red,' 'not recessive red,' and 'crest' allele. 2. Create a male with at least one 'ash-red,' 'not recessive red,' 'crest,' and 'spread' allele 3. Breed. Choose correct sex chromosomes and alleles.	

Puzzle Number	Goal Phenotype	New Inheritance Pattern Information Introduced	Steps:	"Explain" and "Learn More" Information
23	Male, Dilute, T-check	Sex-linked recessive: Dilute gene is on the Z chromosome; 'dilute' allele is recessive to 'not dilute'	Three Steps: 1. Create a male with at least one ‘t-check’ allele. 2. Create a male with at least one ‘t-check’ and one ‘dilute’ allele. 3. Breed. Choose correct sex chromosomes and alleles.	Explain: Dilute inheritance patterns and sex linkage
24	Female, Dilute, Recessive Red		Three Steps: 1. Create a female with at least one ‘recessive red’ allele. 2. Create a female and male with at least one ‘recessive red’ and ‘dilute’ allele. 3. Breed the two offspring. Choose correct sex chromosomes and alleles.	Learn More link: Dilute (includes information about DNA to trait)
25	Female, Dilute, Brown		Two Steps: 1. Create a male with at least one ‘dilute’ allele. 2. Create a male with at least one ‘dilute’ and ‘brown’ allele. 3. Breed. Choose correct sex chromosomes and alleles.	Explain: Dilute gene genetic linkage. Learn More link: Genetic Linkage
26	Male, Ash-red, Dilute and Barless	Because Dilute and color are both on the Z chromosome, recombination between them happens only in males	Three Steps with Add Another: 1. Create a female with at least one ‘barless’ and ‘ash red’ allele. 2. Create a female with at least one ‘dilute’ and ‘barless’ allele and a male with one ‘dilute,’	