Artificial selection

Artificial Selection in chickens is a process by which humans choose phenotypic traits (physical or chemical characteristics) that they wish to develop in the flock. These traits are **genetic** and determined by **genes** that are located on the chicken's DNA (that is contained in **chromosomes**). These genes are passed on from parents to offspring. (Traits can be expressed by a specific gene or multiple genes in several ways). Each gene will have two **alleles** (one on each chromosome). Typically, there are **dominant alleles** and **recessive alleles**. A dominant allele can express itself in the body (the phenotype) in a **homozygous** pair (two of the same allele, HH or hh) or a **heterozygous** state (one of each allele, Hh). A recessive allele can only express itself in the body in a homozygous state (hh). The **phenotype** (outward expression) for a specific **genotype** (trait) in a chicken depends on the makeup of the genetic combination of alleles that are passed on from the male and female parents to the offspring.

Investigation 1: Plumage

Let's look at the following feather colors for chickens.

Red feathers (RR or Rr)

White feathers (rr)

Investigate patterns of feather inheritance in chickens using the Punnett squares below.

Two purebred (RR) red chickens

Prediction: What color do we expect to get as offspring?

Data: What are the genetic results of each cross?

What are the phenotypic results of this cross?

Two purebred (rr) white chickens

Prediction: What color do we expect to get as offspring?

Data: What are the genetic results of each cross?

What are the phenotypic results of this cross?

Two heterozygous (Rr) red chickens

Prediction: What color do we expect to get as offspring?

Data: What are the genetic results of each cross?

What are the phenotypic results of this cross?

One purebred (RR) red chicken and one heterozygous chicken (Rr)

Prediction: What color do we expect to get as offspring?

Data: What are the genetic results of each cross?

What are the phenotypic results of this cross?

One purebred (rr) white chicken and one heterozygous chicken (Rr)

Prediction: What color do we expect to get as offspring?

Data: What are the genetic results of each cross?

What are the phenotypic results of this cross?

Investigation 2: How many feathers do chickens need?

Some chickens have feathered shanks (legs and feet) and some chickens do not. The feathered shank (F) trait is dominant to the unfeathered shank (f) trait. What are some reasons that chickens may or may not have feathers on their shanks?

Feathered shank (dominant)

Unfeathered shank (recessive)

Farmers can support a few to several thousand hens in one location for the production of eggs for consumers like us. To produce eggs you need healthy hens! It is important to keep the coop clean in order to create a healthy environment for the hens.

- What shank feather preference do you think a farmer might prefer to help him best maintain the health of his flock?

- What are the benefits and disadvantages to each shank feather trait?

If a farmer would like to have a flock of unfeathered hens, which chickens should he select to breed to one another to produce unfeathered shank chicks?

A

B

C

D

E

- Show the genotypes of the chickens you would choose for the farmer to breed to produce unfeathered shank chicks.

BONUS! Investigation 3: Multiple allele traits

What's in a comb? Chickens are well known for the 9 identifiable comb types. In fact, William Bateson used the comb type of chickens to show that genetics apply to animals like Gregory Mendel used pea traits to show that genetics apply to plants! Let's look at 4 distinct comb types that are expressed as a combination of two gene combinations: Rose (RR, or Rr) and Pea (PP, or Pp) combs.

RRpp or Rrpp

rrPP or rrPp

R_P_
(must have 1 dominant allele of each gene)

rrpp

What could we produce if we selectively breed a chicken that is purebred (RRpp) for rose comb and a chicken that is purebred (rrPP) for pea comb?

RRpp

×

rrPP

How many comb types do we expect to see?

Rrpp × rrPp

	rP	rp	rP	rp
Rp				
Rp				
rp				
rp				

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