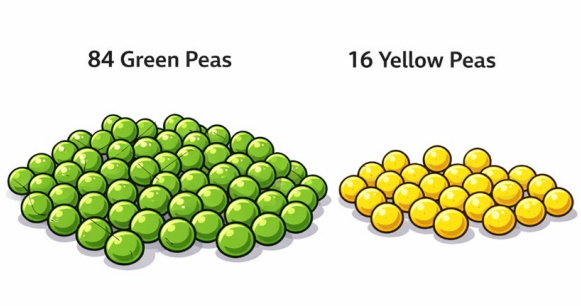
Hardy Weinberg Principle

1. In pea plants, the allele for **yellow seeds (Y)** is dominant to the allele for **green seeds (y)**.

   A sample of **100 pea seeds** contained **84 yellow seeds and 16 green seeds**.

   Using the Hardy–Weinberg principle, **calculate** the frequency of the **dominant allele**

   in this population.



3. In a woodland population of mice, **black fur (B)** is dominant to **brown fur** .

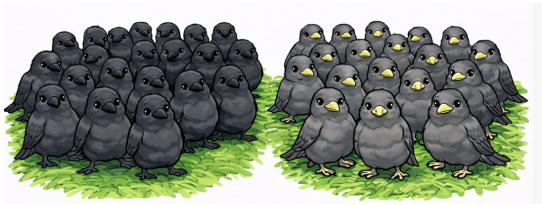
   Out of **1,000 mice**, **360 have brown fur** calculate the frequency of

   homozygous dominant mice.

2. On a small island, a species of bird shows variation in beak colour. **Dark beaks (D)** are dominant to **light beaks (d)**.

   Researchers sampled **500 birds** and found that **125 had light beaks**.

   Calculate the frequency of the **recessive allele**.



4. In eye colour, the brown eye colour allele (B) is dominant to the allele for blue eyes (b).

   The frequency of a recessive allele (q) in a population is **0.7**.

   Using the Hardy–Weinberg principle, **calculate** the frequency of individuals that would be **heterozygous.**

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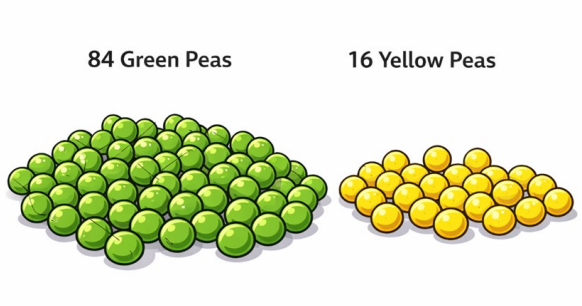


$$q^2 = \frac{16}{100} = 0.16$$

$$q = \sqrt{0.16} = 0.4$$

$$p = 1 - 0.4 = 0.6$$

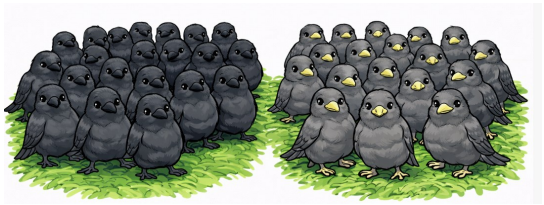
2. On a small island, a species of bird shows variation in beak colour. **Dark beaks (D)** are dominant to **light beaks (d)**.

   Researchers sampled **500 birds** and found that **125 had light beaks**.

   Calculate the frequency of the **recessive allele**.

$$q^2 = \frac{125}{500} = 0.25$$

$$q = \sqrt{0.25} = 0.5$$



3. In a woodland population of mice, **black fur (B)** is dominant to **brown fur** .

   Out of **1,000 mice**, **360 have brown fur** calculate the frequency of

   homozygous dominant mice.

$$q^2 = \frac{360}{1000} = 0.36$$

$$q = \sqrt{0.36} = 0.6$$

$$p = 1 - 0.6 = 0.4$$

$$p^2 = (0.4)^2 = 0.16$$

4. In eye colour, the brown eye colour allele (B) is dominant to the allele for blue eyes (b).

   The frequency of a recessive allele (q) in a population is **0.7**.

   Using the Hardy-Weinberg principle, **calculate** the frequency of individuals that would be **heterozygous.**

$$q = 0.7$$

$$p = 1 - 0.7 = 0.3$$

$$2pq = 2(0.3)(0.7) = 0.42$$

Hardy Weinberg Principle

1. The frequency of a given allele in a population is a measure of how common that allele is as a proportion of the total number of copies of all alleles at a specific locus. For a locus with one dominant allele (A) and one recessive allele (a), the frequency of the dominant allele (p) and the frequency of the recessive allele (q) can be used to calculate the genetic variation of a population using the equations below.

$p + q = 1$ — p = frequency of A allele; q = frequency of a allele

$p^2 + 2pq + q^2 = 1$ — p^2 = frequency of homozygous (AA) individuals; q^2 = frequency of homozygous (aa) individuals; $2pq$ = frequency of heterozygous (Aa) individuals

If the allele frequency of the recessive allele is 0·7, the proportion of individuals that would be heterozygous is

A 0·09
B 0·21
C 0·42
D 0·49.

2. In pea plants, the allele for yellow peas is dominant to the allele for green peas.
A sample of 100 peas contained 84 yellow and 16 green peas.
What is the frequency of the yellow allele in this population?

A 0.36
B 0.40
C 0.60
D 0.84

3. The allele (T) for the ability to taste the bitter chemical phenylthiocarbamide (PTC), is dominant over the allele (t) for the inability to taste the chemical.
400 biology students were tested and 64 were found to be non-tasters.
The percentage of heterozygous students is

A 16%
B 27%
C 32%
D 48%

4. In a population of geese, observers counted 274 yellow goslings and 423 grey goslings.

Grey is dominant (G) and yellow is recessive (g).
Use the Hardy-Weinberg principle to calculate the frequency of the homozygous dominant genotype to 2 decimal places.
Space for calculation

5. Which of the following would be true if a population's gene pool remained unaltered for many generations?

A Mating was random
B Migration was common
C Genetic drift had occurred
D Certain alleles had a selective advantage

6. Describe how the Hardy-Weinberg principle can be used to determine whether evolution is happening within a population. 3

Hardy Weinberg Principle

1. The frequency of a given allele in a population is a measure of how common that allele is as a proportion of the total number of copies of all alleles at a specific locus. For a locus with one dominant allele (A) and one recessive allele (a), the frequency of the dominant allele (p) and the frequency of the recessive allele (q) can be used to calculate the genetic variation of a population using the equations below.

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$$p + q = 1$$
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$$q^2 = \frac{16}{100} = 0.16$$
$$q = \sqrt{0.16} = 0.4$$
$$q = 1 - 0.4 = 0.6$$

3. The allele (T) for the ability to taste the bitter chemical phenylthiocarbamide (PTC), is dominant over the allele (t) for the inability to taste the chemical.

400 biology students were tested and 64 were found to be non-tasters.

The percentage of heterozygous students is

A 16%
B 27%
C 32%
D 48%

$$q^2 = \frac{64}{400} = 0.16$$
$$q = \sqrt{0.16} = 0.4$$
$$p = 1 - 0.4 = 0.6$$
$$2pq = 2(0.6)(0.4) = 0.48$$
$$= 48\%$$

4. In a population of geese, observers counted 274 yellow goslings and 423 grey goslings.

Grey is dominant (G) and yellow is recessive (g).

Use the Hardy-Weinberg principle to calculate the frequency of the homozygous dominant genotype to 2 decimal places.

Space for calculation

$$274 + 423 = 697$$
$$q^2 = \frac{274}{697} \approx 0.393$$
$$q = \sqrt{0.393} \approx 0.63$$
$$q = 1 - 0.63 = 0.37$$
$$p^2 = (0.37)^2 \approx 0.14$$

5. Which of the following would be true if a population's gene pool remained unaltered for many generations?

A Mating was random
B Migration was common
C Genetic drift had occurred
D Certain alleles had a selective advantage

6. Describe how the Hardy-Weinberg principle can be used to determine whether evolution is happening within a population. 3

1. Allele frequencies remain constant in absence of evolutionary influences
2. Genotype frequency calculated by $p^2 + 2pq + q^2$
3. Any 1 from following
   P^2 = frequency of homozygous dominant genotype
   q^2 = frequency of homozygous recessive genotype
   2pq = frequency of heterozygous genotype
4. p represents frequency of dominant allele OR q represents frequency of recessive allele
5. Mainitaining HW equilibrium requires (any 1)
   - random mating
   - large population size
   - no mutations
   - no gene flow