

how traits pass down, how sex is decided, and the evidence that species change over time

The vocabulary of inheritance

- **heredity** is the passing of traits from parents to offspring, and **variation** is the differences between them
- a **gene** is a segment of DNA carrying the instruction for a trait, and its alternative forms are **alleles**
- **genotype** is the genetic makeup, written with letters, and **phenotype** is the visible appearance
- **homozygous** means the two alleles are the same, TT or tt , and **heterozygous** means they differ, Tt
- a **dominant** allele shows in the phenotype even when only one copy is present, and a **recessive** one shows only when both copies are recessive
- so TT and Tt look identical while only tt looks different, which is why a recessive trait can skip a generation

Mendel's laws

- Mendel worked on the **garden pea**, chosen because it has clear contrasting traits, a short life cycle and self pollinates naturally
- **law of dominance**: in a pair of contrasting alleles, only the dominant one is expressed in the first generation
- **law of segregation**: the two alleles of a pair **separate** during gamete formation, so each gamete carries only one
- **law of independent assortment**: alleles of **different** traits are inherited **independently** of one another
- a **monohybrid cross** of two heterozygotes gives a phenotype ratio of **3 : 1** and a genotype ratio of **1 : 2 : 1**
- a **dihybrid cross** of two double heterozygotes gives **9 : 3 : 3 : 1**

A monohybrid cross

Q. Two heterozygous tall pea plants (Tt) are crossed. Give the genotype and phenotype ratios of the offspring.

- ① each parent is Tt , so each produces two kinds of gamete, T and t , in equal numbers
- ② combining them gives four equally likely results: TT , Tt , Tt and tt
- ③ the **genotype ratio** is therefore 1 TT to 2 Tt to 1 tt , that is **1 : 2 : 1**
- ④ for the phenotype, TT and Tt both look tall, since T is dominant, so three of the four are tall
- ⑤ only tt is short, being the one homozygous recessive
- ⑥ so the **phenotype ratio** is 3 tall to 1 short, the classic **3 : 1**

	T	t
T	TT	Tt
t	Tt	tt

the grid with one parent's gametes across the top and the other's down the side: three of the four boxes carry at least one dominant T and so look tall, and only the single tt box is short

Answer

genotype 1 : 2 : 1, phenotype 3 tall : 1 short

