

- Any organism is a by-product of both its genetic makeup and the environment. To understand this in detail, we must first appreciate some basic genetic vocabulary and concepts.

What is the definition of a genotype?

- In biology, a gene is a section of DNA that encodes a trait. The precise arrangement of nucleotides (each composed of a phosphate group, sugar and a base) in a gene can differ between copies of the same gene. Therefore, a gene can exist in different forms across organisms. These different forms are known as alleles. The exact fixed position on the chromosome that contains a particular gene is known as locus.
- A diploid organism either inherits two copies of the same allele or one copy of two different alleles from their parents. If an individual inherits two identical alleles, their genotype is said to be homozygous at that locus.
- However, if they possess two different alleles, their genotype is classed as heterozygous for that locus. Alleles of the same gene are either autosomal dominant or recessive. An autosomal dominant allele will always be preferentially expressed over a recessive allele.

The subsequent combination of alleles that an individual possesses for a specific gene is their **genotype**.

Genotype examples

Let's look at a classic example – eye color.

- A gene encodes eye color.
- In this example, the allele is either brown, or blue, with one inherited from the mother, and the other inherited from the father.
- The brown allele is dominant (B), and the blue allele is recessive (b).
If the child inherits two different alleles (heterozygous) then they will have brown eyes. For the child to have blue eyes, they must be homozygous for the blue eye allele.

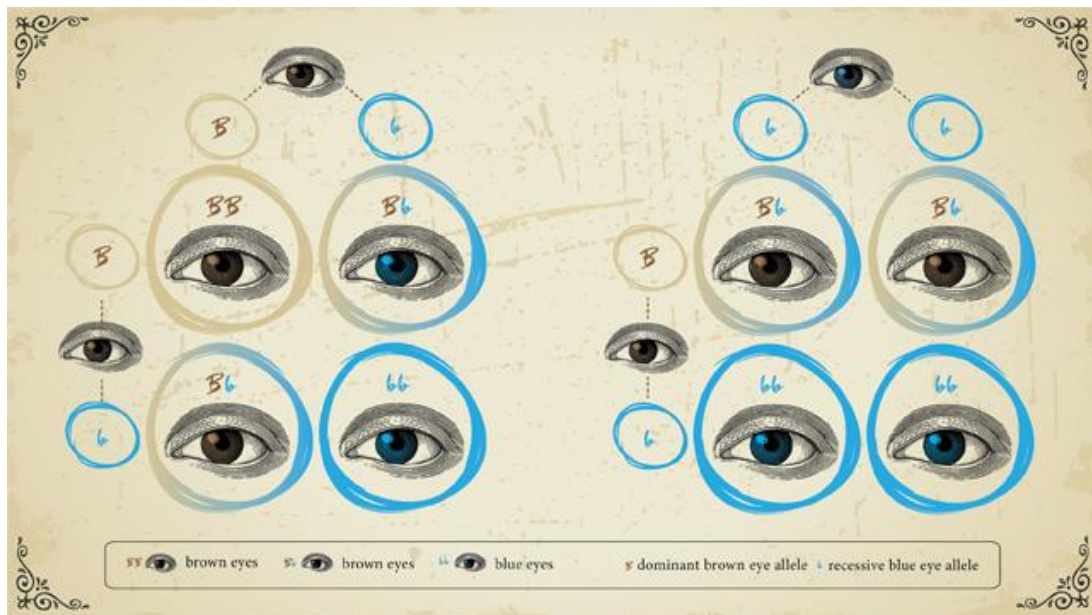


Figure 1: Inheritance chart detailing how an individual may inherit blue or brown eyes depending on the alleles carried by their parents, with the brown eye color allele being dominant and the blue eye color allele being recessive.

Other examples of genotype include:

- Hair color
- Height
- Shoe size

What is the definition of a phenotype?

The sum of an organism's observable characteristics is their phenotype. A key difference between phenotype and genotype is that, whilst genotype is inherited from an organism's parents, the phenotype is not.

The phenotype is influenced by the genotype and factors including:

- Epigenetic modifications
- Environmental and lifestyle factors



Figure 2: Flamingos are naturally white in color, it is only the pigments in the organisms that they eat that cause them to turn vibrantly pink.

Phenotype examples

- Flamingos are a classic example of how the environment influences the phenotype. Whilst renowned for being vibrantly pink, their natural

color is white – the pink color is caused by pigments in the organisms in their diet.

- A second example is an individual's skin color. Our genes control the amount and type of melanin that we produce, however, exposure to UV light in sunny climates causes the darkening of existing melanin and encourages increased melanogenesis and thus darker skin.

Genotyping Techniques:

- PCR
- DNA Microarray
- Allele-specific Oligonucleotide (ASO) Probes
- DNA Hybridization