Genetics

Inheritance

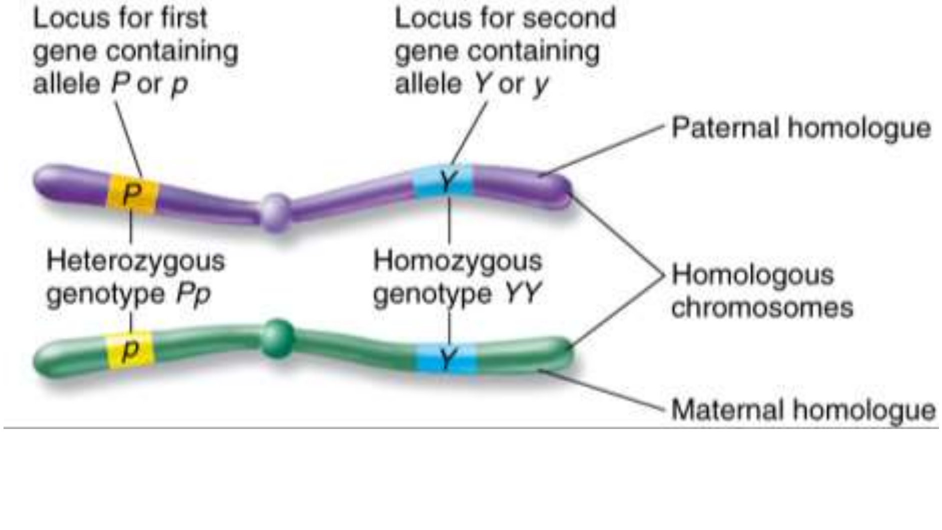
You must have noticed some characteristics or traits in common with each of your parents. On the other hand, you differ from your siblings and parents in many respects. There are some characteristics that passed on the next generation while others appear to be lost. Work of Gregor Mendel in 19^{th} century provided the basis to understand the passing of traits from one generation to the next. Since 1856 Gregor Mendel carried out a large number of experiments which laid to foundation of **genetics**, the study of heredity. Even if Mendel had no knowledge of genes or chromosomes, he showed that inheritance depends on the transfer of discrete (separate) factors (genes) from parents to offspring.

Today, we know that characteristics of organisms are controlled by **genes** on chromosomes. The position of a gene on a chromosome is called its **locus**. In sexually reproducing organisms, each individual has two copies of the same gene, as there are two versions of the same chromosome (**homologous chromosomes**). One copy comes from each parent. The gene for a characteristic may have different versions, but the different versions are always at the same locus. The different versions are called **alleles**. For example, in pea plants, there is a purple-flower allele (B) and a white-flower allele (b). Different alleles account for much of the variation in the characteristics of organisms.

When gametes unite during fertilization, the resulting zygote inherits two alleles for each gene. One allele comes from each parent. The alleles an individual inherits make up the individual's **genotype**. The two alleles may be the same or different. An organism with two alleles of the same type (BB or bb) is called a **homozygote**. An organism with two different alleles (Bb) is called a **heterozygote**. This results in three possible genotypes.

Alleles	**Genotypes**	**Phenotypes**
B (purple)	BB (homozygote)	purple flowers
b (white)	Bb (heterozygote)	purple flowers
	bb (homozygote)	white flowers

The expression of an organism's genotype produces its **phenotype**. The phenotype refers to the organism's characteristics, such as purple or white flowers. Different genotypes may produce the same phenotype. For example, BB and Bb genotypes both produce plants with purple flowers. Why does this happen? In a Bb heterozygote, only the B allele is expressed, so the b allele doesn't influence the phenotype. In general, when only one of two alleles is expressed in the phenotype, the expressed allele is called the **dominant allele**. The allele that isn't expressed is called the **recessive allele**.



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Key terms

Recessive allele, Phenotype, Heredity, Heterozygote, Gene, Hybrid, Genetics, Allele, Genotype, Homozygote, Dominant allele

______________ the passing of characteristics from parents to offspring

______________ the science of heredity

______________a segment of DNA, occupying a specific place on a chromosome that is the basic unit of heredity

______________ the position of a gene on a chromosome

______________ different version of a gene

______________ an organism with two alleles of the same type

______________ an organism with two different alleles

______________ expressed allele in a heterozygote

______________ allele that is not expressed in a heterozygote

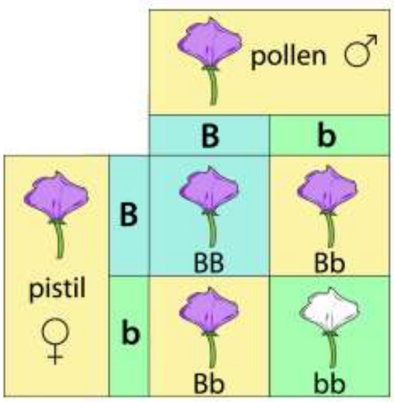
______________ the alleles an individual inherits

______________ the expression of an organism's genotype

______________ the resulting offspring from a cross between two different types of parents

Punnett Square

A Punnett square is a chart that allows you to easily determine the expected percent of different genotypes in the offspring of two parents. An example of a Punnett square for pea plants is shown below. In this example, both parents are *heterozygous* for flower colour (Bb). The gametes produced by the *male* parent are at the top of the chart, and the gametes produced by the *female* parent are along the side. The different possible combinations of alleles in their offspring are determined by filling in the cells of the Punnett square with the correct letters (alleles).



Predicting offspring genotypes

In the cross shown in the figure above, you can see that one out of four offspring (25 percent) has the genotype BB, one out of four (25 percent) has the genotype bb, and two out of four (50 percent) have the genotype Bb. These percent of genotypes are what you would expect in any cross between two heterozygous parents. Of course, when just four offspring are produced, the actual percent of genotypes may vary by chance from the expected percent. However, if you considered hundreds of such crosses and thousands of offspring, you would get very close to the expected results.