

## Gene Inheritance and Transmission

Explain what P1, F1 and F2 generations are:

- original parents are called P1 or parental generations
- their offspring are the F1 or first filial generation, the progeny resulting from the first cross in a series
- F2, second filial generation are the individuals from the selfing of the F1 generation

List Mendel's postulates of inheritance and define the law of independent assortment

- **UNIT FACTORS IN PAIRS.** Genetic characters are controlled by unit factors existing in pairs in individual organisms.
- **DOMINANCE/RECESSIVENESS.** When two unlike unit factors responsible for a single character are present in a single individual, one unit factor is dominant to the other, which is said to be recessive
- **SEGREGATION.** During the formation of gametes, the paired unit factors separate randomly so that each gamete receives one or the other with equal likelihood.

Define genotype and phenotype

- **genotype:** specific allele or genetic constitution of an organism
- **phenotype:** observable properties of an organism that are genetically controlled

## Extensions of Mendelian Genetics

Examples and definitions of different variations of Mendelian inheritance:

- **Lethal alleles** – presence of mutant gene product may somehow override normal function of wild type product. Dominant lethal allele – allele that causes death of organism, whether homozygous or heterozygous. Recessive lethal – allele that is lethal when homozygous. E.g. Huntington's disease: because the onset of the disease is slow, individuals can pass it on to offspring and hence allows the allele to be maintained in the population.
- **Incomplete dominance** – both alleles blend their affect, blend of phenotypes, not genes. Red + White flower → Pink flower. Examples: Tay-Sachs disease, where homozygous recessive individuals die during their first one to three years of life
- **Codominance** – both alleles show their effects, neither allele are dominant, and both are expressed. Example: White + Red cow → Roan cow (red and white hairs, not PINK), MN blood group exhibiting both M and N type of glycoprotein on surface of red blood cells
- **Multiple alleles** – three alleles of one gene. E.g. Bombay phenotype
- **Epistasis** – one gene masks the phenotypic expression of another
- **Pleiotropy** – one gene influences multiple phenotypic traits. Example: phenylketonuria (PKU) – caused by over 400 mutations in a single gene that codes for enzyme phenylalanine hydroxylase, which convert amino acid phenylalanine to tyrosine
- **Genetic heterogeneity** – single phenotype may be caused by any one of a multiple number of alleles
- **Penetrance** – probability of a gene or genetic trait being expressed