

A Glossary of Genetic Terms

Alleles: different versions of the same gene (found at the same locus but in homologous chromosomes or in different individuals) that may produce different phenotypes.

Allele frequency: the fraction of all the alleles of a gene in a population that are of one type.

Assortative mating: a mating scheme that relies on the pairing of unrelated individuals with similar phenotypes to obtain consistency of type and reinforce desirable traits.

Codominant alleles: two alleles that have different effects that are distinguishable in a heterozygous individual (e.g. AB blood groups)

Cross-breeding: crossing two different breeds.

Dominant allele: one that determines the phenotype even when there is only one copy (i.e. in a heterozygous individual).

Drift: changes in allele frequencies over time due to chance (as opposed to selection or mutation).

Effective population size (N_e): the size of a hypothetical stable, randomly-mating population that would have the same rate of gene loss or increase in inbreeding as the real population (size N). As all finite populations are inbred to some degree and generally do not choose mates at random, N_e is typically $1/10 N$ or less, particularly if fewer males breed than females.

Epistasis: used to describe the situation where one gene's expression prevents the expression of another (e.g. you cannot determine whether an albino would have had black or brown hair, though these two traits are controlled by separate genes.)

Fitness (relative): The reproductive success of individuals of a particular genotype relative to the most fit genotype.

Fixation: loss of all alleles of a gene but one.

Founder: an individual drawn from a source population who contributes genetically to the derived subpopulation.

Founder effect: changes in allele frequencies that occur when a subpopulation is formed from a larger one. Typically many rare and usually undesirable alleles are excluded while a few carried by the founders get a big boost in frequency.

Founder equivalents: the number of hypothetical founders that would have the same diversity as the descendant population. Generally much smaller than the actual number due to unequal use and allele loss (gene dropping).

Gene: that portion of the genome that carries the information for a single protein. (In cases of proteins with multiple subunits, there may be a gene for each.)

Gene dropping: loss of alleles due to genetic drift.

Genetic bottleneck: when population numbers are temporarily reduced to a level insufficient to maintain the diversity in the population.

Genetic diversity: usually expressed in terms of percentage of genes that are polymorphic and/or are heterozygous.

Genome: the total genetic makeup of an organism.

Heritable: passed on from parents to progeny through the chromosomes/DNA.

Heritability: the fraction of the variability in a trait that is caused by genetic differences.

Heterozygous: carrying two different alleles of a gene.

Heterozygous advantage: a situation where the heterozygous genotype for a particular gene shows the highest relative fitness.

Heterozygous insufficiency: when the heterozygous genotype lacks sufficient gene product to have the normal phenotype. (Approximately equivalent to partial dominance.)

Heterosis: a situation where crossing two inbred lines yields progeny that are more healthy/vigorous than their parents. (More commonly used in plant breeding.)

Homologous chromosomes: in higher plants and animals, chromosomes are found in nearly identical "homologous" pairs, one coming from the sire and the other from the dam. A dog has 39 pairs, or 78 in total. Only one of each, chosen at random, is passed on through eggs or sperm to the progeny.

Linebreeding: a scheme that attempts to maintain a high contribution of one or two ancestors through successive generations. Often used by breeders for any inbreeding less intensive than between first-degree relatives.

Linkage: a measure of how frequently two genes found on the same chromosome remain together during gamete (egg or sperm) formation.

Locus: the location of a gene on a chromosome.

Map (aka linkage map): a drawing showing the location of and relative distances between genes on a chromosome.

Mean kinship (mk): a measure of how related an individual is to the other members of a population. Generally computed as the average IC for the hypothetical progeny of the individual mated to all other members of the population (both sexes). A low average mk for a population indicates that most of the diversity carried by the founders has been retained.

Monomorphic genes: have only one common allele (rare alleles with frequencies of less than 0.001% may still occur).

Mutation: a change in the sequence of the base pairs in a DNA molecule.

Mutation rate: the number of new mutations that occur per gene per gamete per generation.

Outcrossing: mating two individuals of the same breed that are sufficiently unrelated that the IC of the progeny is lower than the average of the parents.

Polymorphic genes: have 2 or more common alleles in the population.

Recombination: the reciprocal exchange of portions of two homologous chromosomes (usually equivalent) during gamete formation.

Recombinant frequency (RF): how often two linked genes are separated by recombination, generally expressed as a percentage of total progeny.