# Additive and non-additive genetic variation

Continuously distributed traits are assumed to be multifactorial i.e. influenced by many different factors. Some of these factors will be different genes; some will be non-genetic factors including chance, climate and nutrition. For geneticists all these non-genetic factors constitute ‘environment’.

The performance of an individual for a particular trait is called the phenotypic value (P) and this is made up of a genetic component (genotypic value) and an environmental component E (environmental deviation).

P = G + E

The environmental deviation is defined to have a mean of zero and consequently, the average performance of a particular genotype is the genotypic value.

The breeding value of an animal is not necessarily equal to the genotypic value. The genotypic value is equal to the breeding value (A - the additive effect) plus a deviation due to dominance (D) and a deviation due to interaction between genes at different loci (I - epistatic deviation)

G = A + D + I

The additive genetic component is the most important for selective breeding and the dominance deviation and epistatic components are treated as noise. But the dominance and epistatic components are utilised in crossbreeding schemes. The proportion of the variance that is due to genotypic values (VG/VP) is heritability in the broad-sense. In contrast, heritability in the narrow sense is the proportion of the variance that is attributable to variance in breeding values (VA/VP). It is the narrow-sense heritability (h2) which predicts the response to selection and it is the term of most value to animal breeders. The heritability of a trait and the breeding value of an animal can vary between populations, depending on gene frequencies, type of gene action and environmental effects.