

Gene Interactions:

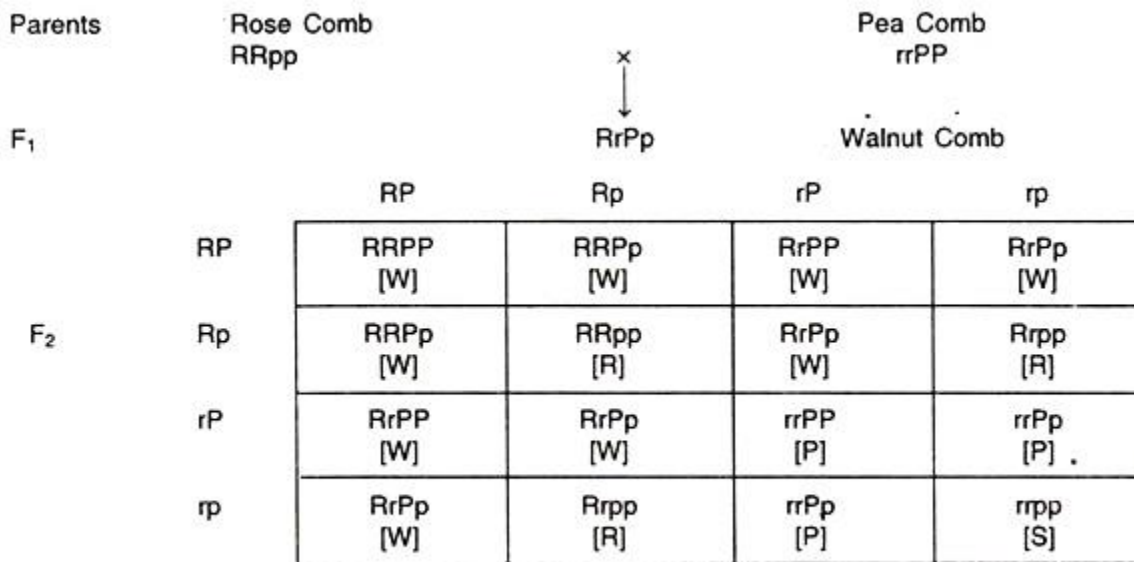
When expression of one gene depends on the presence or absence of another gene in an individual, it is known as gene interaction. The interaction of genes at different loci that affect the same character is called epistasis. Epistasis is a digenic gene action wherein two genes at different loci interact in the expression of one character. Epistasis leads to the modification of normal dihybrid phenotypic ratio in F_2 generation.

The term epistasis was first used by Bateson in 1909 to describe two different genes which affect the same character, one of which masks the expression of other gene. The gene that masks another gene is called epistatic gene, and the gene whose expression is masked is termed as hypostatic gene. Epistasis is also referred to as inter-genic or inter-allelic gene interaction.

Gene Interaction for Comb Shape in Poultry: Another example of epistatic interaction

Bateson and Punnett conducted research showing that the shape of the comb in chickens is controlled by two different genes on two different chromosomes. There are three types of comb shape in poultry, viz., rose, pea and single. The comb shape is controlled by two pairs of alleles. The rose comb is governed by a dominant gene R and pea comb by a dominant gene P. The single comb is governed by two recessive genes (rrpp). When a cross was made between rose (RRpp) and pea (rrPP), a new phenotype called walnut developed in F_1 . The walnut comb developed as a consequence of combining two dominant alleles R and P together in F_1 . In this case, neither the rose comb nor the pea comb appeared to be dominant, because the F_1 offspring had their own unique phenotype, that is walnut comb shape. Inter-mating of F_1 birds produced four types of combs, viz., walnut, rose pea and single in 9: 3: 3: 1 ratio in F_2 generation.

Here individuals with R-P-(9/16) genotypes produce walnut comb, because two dominant genes together produce walnut comb. Individuals with R-pp (3/16) will give rise to rose comb, and those with rrP-(3/16) genotypes will produce pea comb. The single comb (1/16) will develop from a double recessive, genotype (Fig. 8.1). Because the four comb shapes appeared in a 9:3:3:1 ratio, it seemed that two different genes must play a role in comb shape. Such case of gene interaction was observed by Bateson and Punnett for comb shape in poultry.



W = Walnut, R = Rose, P = Pea, and S = Single comb

Fig. 8.1. Gene interaction for comb shape in poultry.