

# Teaching Tips/Notes

## Thinking of Epistasis as Playing in a Restricted Playground

Inheritance through a single gene (H), when epistasis does not interfere, is straightforward. In this case, genotypic frequencies at H locus i.e., 1HH:2Hh:1hh would lead to phenotypic ratio of 3H:1h, when H is dominant over h. Under the two types of dominant and recessive epistasis, the functionality of the hypostatic locus (H) is interfered by allelic state of the epistatic locus (E). Let's imagine that E alone has the 3:1 ratio. Under both dominant and recessive epistasis, the locus E sets specific rules for expression of the trait of interest. These rules define the borders of a restricted playground for the H gene to be in effect. One possible rule set by E is that H can only be in effect if and only if E locus is homozygous recessive (ee). This simply means that H has access to only  $\frac{1}{4}$  of the playground (Fig 1a). Within this  $\frac{1}{4}$  area, the locus H will impose its 3H:1h effect. The other  $\frac{3}{4}$  is already set by the dominant phenotype of E locus (whatever that could be). In other words, in dominant epistasis, H cannot play role in determination of the trait of interest when allele at epistatic locus is dominant (E). This will result in the dominant epistatic ratio of (3E:1e) (3H:1h) = 12E:3H:1h. Another possible rule is that H is only in effect when dominant allele of the E locus is in effect. In this case, the H gene has access to  $\frac{3}{4}$  of the playground and within this  $\frac{3}{4}$  area (Fig 1b), the locus H will impose its 3H:1h effect. In recessive epistasis, H cannot play role in determination of the trait of interest when allele at epistatic locus is recessive (E). This will result in the recessive epistatic ratio (3E:1e) (3H:1h) = 9H:3h:1e. A more comprehensive diagram for showing genotyping and phenotypic ratios with demonstration of exact restricted areas is also provided (Fig. 2).

Figure 1.

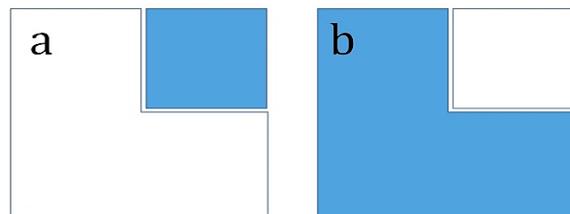
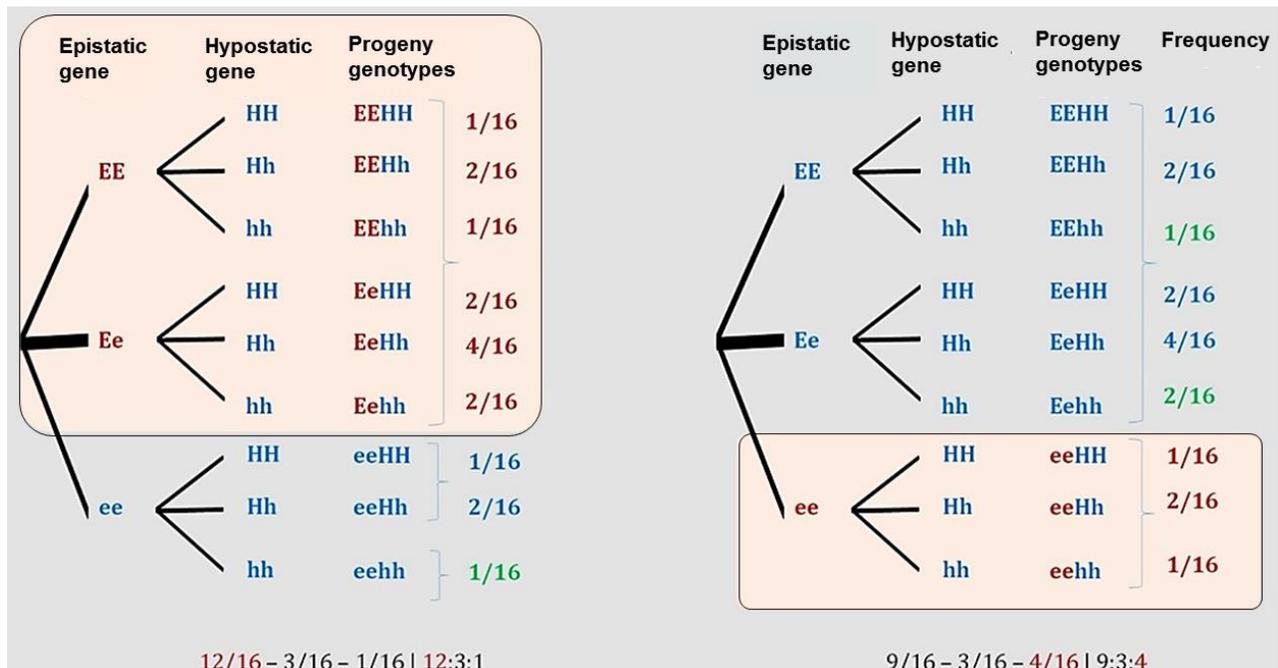


Figure 2.



Submitted by–  
Mohsen Mohammadi  
Purdue University, West Lafayette, IN