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FACULTY OF ENGINEERING &  
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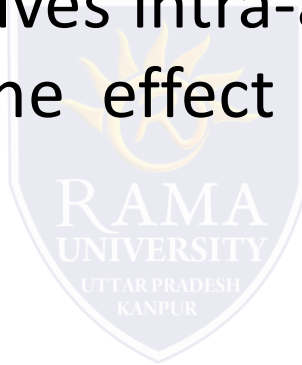
## Introduction

- Epistasis is the phenomenon where the effect of one gene is dependent on the presence of one or more genes.
- Originally the term meant that the phenotypic effect of one gene is masked by a different gene.

In epistasis, the gene that does the masking is called an epistatic gene; the gene whose effect is masked is a hypostatic gene. Epistatic genes may be recessive or dominant in their effects.

## Types of Epistasis

**Dominance:** It involves intra-allelic gene interaction. One allele hides the effect of other allele at the same gene pair



One gene hides the effect of other gene at different gene loci .

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## Dominant Epistasis

Dominant allele (eg., A) of one gene hides the effect of allele of another gene (eg., B) and expresses itself phenotypically.

- The B allele (hypostatic) will be expressed only when gene locus A contains two recessive (aa) alleles.
- Thus, the genotype AA BB or Aa Bb and AA bb or Aa bb produce the same phenotype
- genotype aa BB or aa Bb and aa bb produce two additional phenotypes.
- This type of dominant epistasis modifies the classical ratio of 9:3:3:1 into 12:3:1

| Epistatic alleles | Hypostatic alleles | Phenotypic Expression |
|-------------------|--------------------|-----------------------|
| aa                | bb                 | b                     |
| aa                | BB, Bb             | B                     |
| AA, Aa            | Bb, Bb, bb         | A                     |

## Example:

- Studied in summer squash (*Cucurbita pepo*)
  - Common fruit colors-white,yellow & green
  - White (W) is dominant over colored squash
  - Yellow (Y) is dominant over green squash
  - Pure breeding white fruited variety is crossed with the double recessive green variety,F1 hybrids are all white
  - When the hybrids are selfed-white, yellow &green fruited plants arise in the ratio of 12:3:1

❖ The effect of dominant gene 'Y' is masked by the dominant gene 'W' (epistatic gene)

❖ P WWYY X wwyy  
(white) ↓ (green)

❖ F1 WwYy  
(white) (selfed)

❖ F2  
White:Yellow:Green

❖ 12 : 3 : 1



| ♂/♀ | WY       | Wy       | wY       | wy       |
|-----|----------|----------|----------|----------|
| WY  | WWY<br>Y | WWY<br>y | WwY<br>Y | Ww<br>Yy |
| Wy  | WWY<br>y | WWyy     | WwYy     | Wwy<br>y |
| wY  | WwY<br>Y | WwYy     | wwYY     | wwY<br>y |
| wy  | WwYy     | Wwyy     | wwYy     | wwy<br>y |

## **Recessive epistasis (Supplementary interaction)**

- Recessive allele (aa) of one gene locus hides the effect of another gene locus (BB, Bb or bb) and expresses itself phenotypically.
- The alleles of B locus express themselves only when epistatic locus has dominant alleles (eg., AA or Aa).
- This will modify the ratio 9:3:3:1 to ratio 9:3:4



| Epistatic alleles | Hypostatic alleles | Phenotypic Expression |
|-------------------|--------------------|-----------------------|
| aa                | BB, Bb, bb         | a                     |
| AA, Aa            | BB, Bb             | B                     |
| AA, Aa            | bb                 | b                     |

## Example:

- In horses, brown coat color (*B*) is dominant over tan (*b*).
- However, how that gene is expressed in the phenotype is dependent on a second gene that controls the deposition of pigment in hair.
- The dominant gene (*C*) codes for the presence of pigment in hair, whereas the recessive gene (*c*) codes for the absence of pigment.

**BbCc** x **BbCc**



Sperm

**BC**   **bC**   **Bc**   **bc**

Ova

|           |             |             |             |             |
|-----------|-------------|-------------|-------------|-------------|
| <b>BC</b> | <b>BBCC</b> | <b>BbCC</b> | <b>BBCc</b> | <b>BbCc</b> |
| <b>bC</b> | <b>BbCC</b> | <b>bbCC</b> | <b>BbCc</b> | <b>bbCc</b> |
| <b>Bc</b> | <b>BBCc</b> | <b>BbCc</b> | <b>BBcc</b> | <b>Bbcc</b> |
| <b>bc</b> | <b>BbCc</b> | <b>bbCc</b> | <b>Bbcc</b> | <b>bbcc</b> |



9



4



3

