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Epistasis

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What is Epistasis?

- **Gene interactions** occur when **two or more** allelic or non-allelic **genes** of same genotype influence the outcome of particular phenotypic characters.
- **Non-allelic gene interaction** occurs when a single character is developed due to 2 or more genes affecting expression of each other in different ways.
- **Epistasis** is a form of gene interaction in which one gene masks the phenotypic expression of another.
- When a gene or gene pair masks or prevents the expression of other non-allelic gene, it is called **Epistasis.**

Epistatic and Hypostatic

- The alleles that are masking the effect are called **epistatic alleles**
- The alleles whose effect is being masked are called the **hypostatic alleles**

Types of Epistasis

Epistasis can be described as either

- **Recessive Epistasis** or
- **Dominant Epistasis**

Remember Dihybrid Cross?

Dihybrid Cross
Dominant and Recessive
T=Tall, t=short
B=Black, b=white
Cross: TtBb x TtBb

	TB	Tb	tB	tb
TB	TTBB	TTBb	TtBB	TtBb
Tb	TTBb	TTbb	TtBb	Ttbb
tB	TtBB	TtBb	ttBB	ttBb
tb	TtBb	Ttbb	ttBb	ttbb

Genotypic ratio: 1:2:2:1:4:1:2:2:1

Phenotypic ratio: 9:3:3:1

T_B_: 9
T_bb: 3
ttB_: 3
ttbb: 1

Recessive Epistasis

- Also known as supplementary factor

- In this case, **homozygous recessive condition of a gene** determines the phenotype irrespective of the alleles of other gene pairs i.e., **recessive allele hides the effect of the other gene.**

Labrador Retrievers

- Fur color in Labrador Retrievers is controlled by two separate genes.

Gene 1: Represented by B

: Controls color

Gene 2: Represented by E

: Controls expression of B

Labrador Retrievers

- If a Labrador retriever has a dominant B allele, they will have black fur.

- If they have two recessive alleles (bb) they will have brown fur.

Labrador Retrievers

- If a retriever receives at least one **dominant "E" allele,** they will remain the color that the "B" allele coded for.
  - Either **black** of **brown**

- However, if a dog receives a pair of **homozygous recessive "e" alleles (ee)**, they will be **golden** regardless of their "B" alleles!

Labrador Retrievers

- BBEE and BbEe --> Black
- bbEE and bbEe --> Brown
- BBee, Bbee, or bbee --> Golden

B_E_: 9
bbE_: 3
B_ee: 3
bbee: 1

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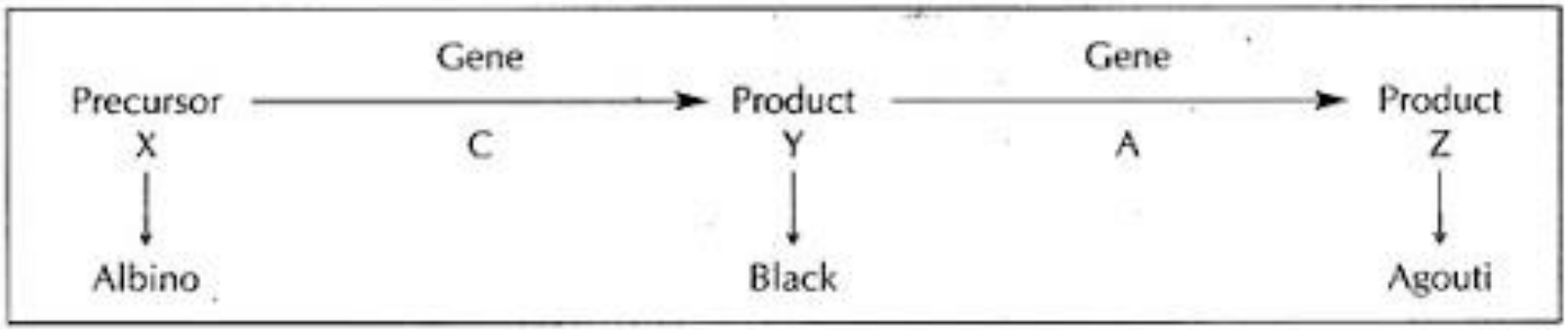
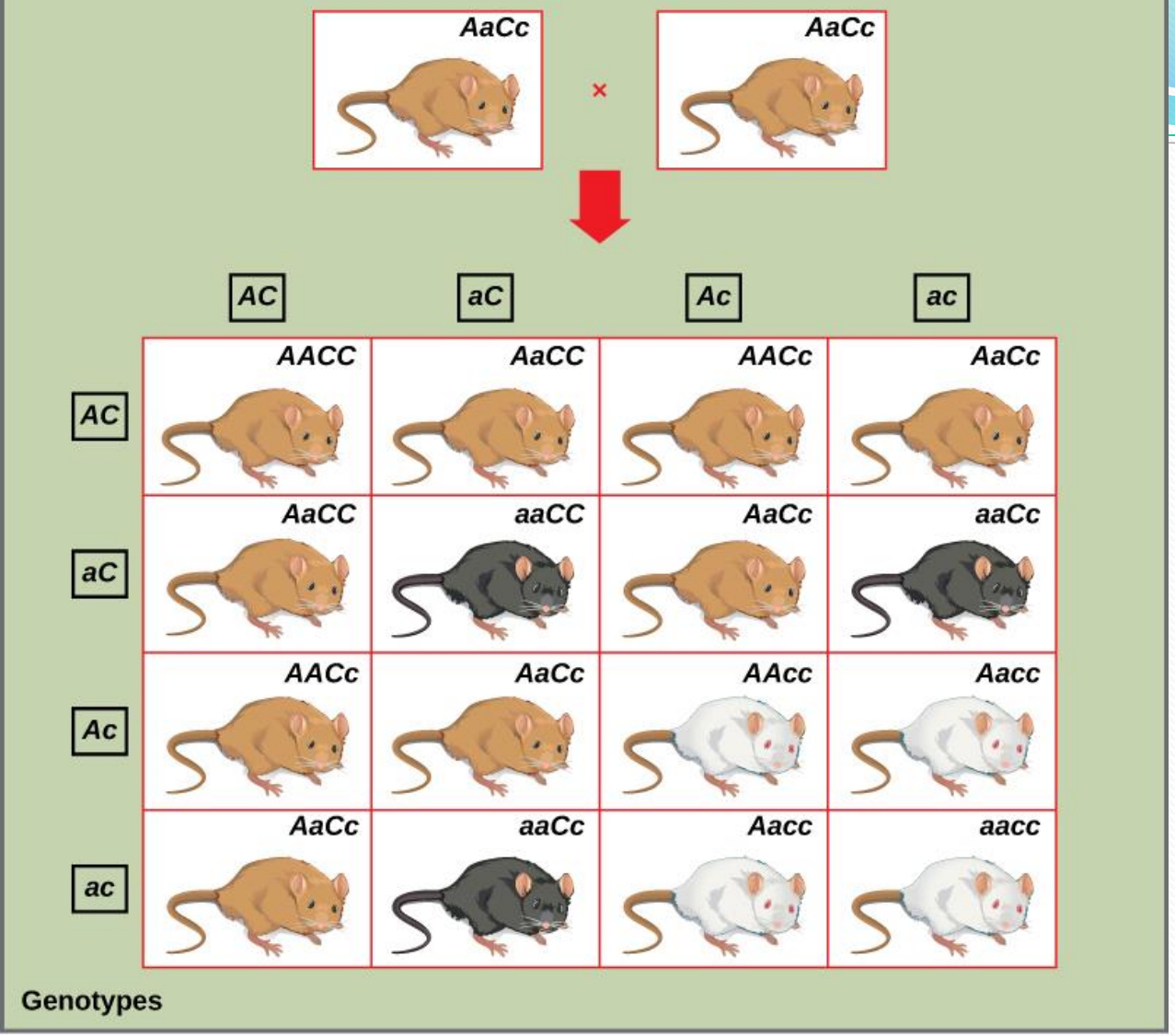
Coat colour of mice

- The wild-type coat color**, agouti (AA)** is dominant to **black fur (aa).**
- A separate **gene C**, when present as the **recessive homozygote** (**cc**), negates any expression of pigment from the A gene and results in an **albino mouse**.
- **C gene is epistatic to the A gene**





A_C_: 9
aaC_: 3
A_cc: 3
aacc: 1

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Grain Colour In Maize

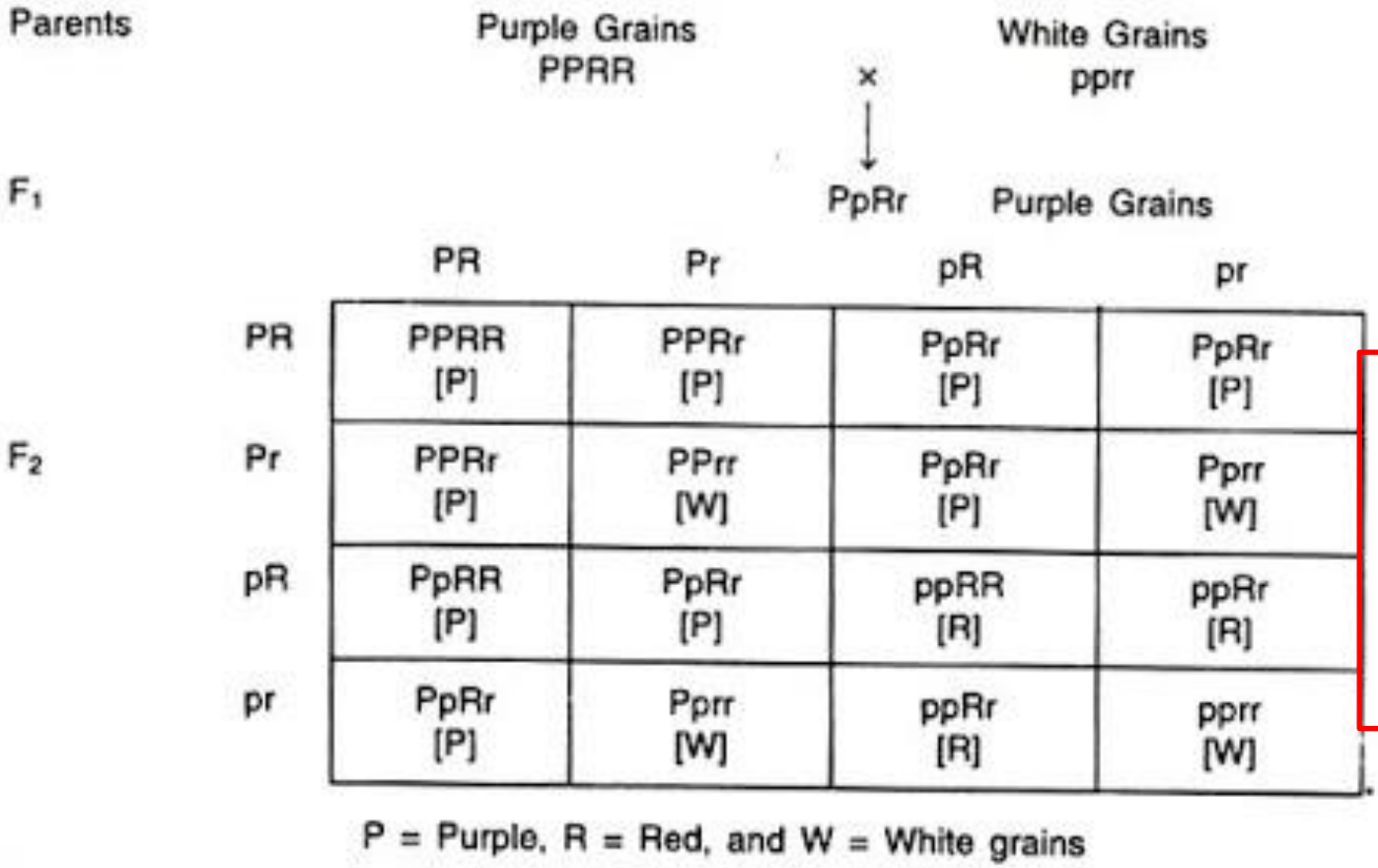
Purple Corn **Red Corn** **White Corn**

R gene = Red colour

P gene= Purple colour

Homozygous Recessive of r **(rr)** is Epistatic to **gene P**

Grain Colour In Maize



R_P_: 9
R_pp: 3
rrP_ 3
rrpp: 1
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Fig. 8.2. Recessive epistasis for grain colour in maize. The normal dihybrid segregation ratio of 9 : 3 : 3 : 1 is modified to 9 : 3 : 4 in F_2.

Things to do:

Q1: What is **Epistasis**? 2 marks

Q2: What do you mean by **epistatic and hypostatic alleles?** 2 marks

Q3: What is the **Expected Ratio** for **Recessive Epistasis**? 1 mark

Q4: Explain how epistasis works for **grain colour of maize.** 10 marks

Q5: What kind of gene ineraction do we get in **coat colour of mice**? Explain with flow chart. 1+5 marks

Q6: You have decided to cross your **golden retriever (bbee)** with the neighbor's **chocolate retriever (bbEe)**. What color pups will they have? 6marks