LAB - 5 –

EPISTASIS

Epistasis takes place when the action of one gene is modified by one or several other genes, which are sometimes called **modifier genes**. The gene whose phenotype is expressed is said to be **Epistatic**, while the phenotype altered or suppressed is said to be **Hypostatic**.

1- dominant epistasis 12:3:1

Here the epistatic gene may mask the effect of the Hypostatic gene)). EXAMPLE / **the color of summer Squash fruit**, there are three color (white - yellow - green) White dominants on the yellow and green dominants on the green .

A-B- , A-bb	the phenotype of epistatic gene (A)	(12)
aaB-	the phenotype of hypostatic gene (B)	(3)
aabb	different phenotype	(1)

in the color of the fruit in the Summer Squash plant, there are individuals gives white color fruit and the other gives the green color (just in recessive case), the (Y) gene is special for yellow color, i.e the (W) gene for White color exceed the (Y) gene for yellow and yellow (Y) exceed the green (w) That's where the yellow fruit be recessive in front of the white , but it is dominant on green and, the white color is dominant on yellow and green.

- 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

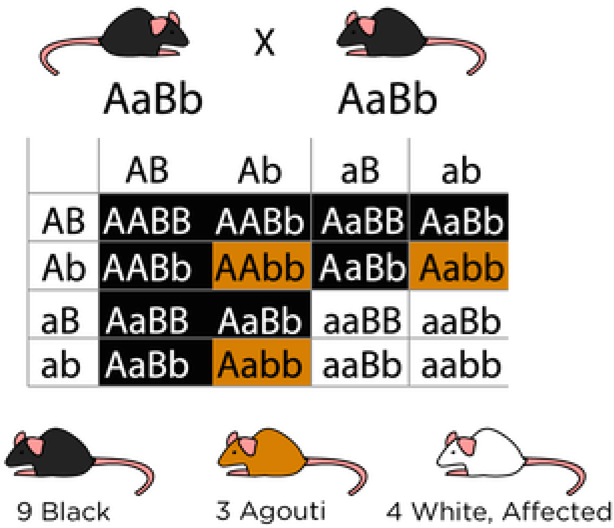
♂/♀	WY	Wy	wY	wy
WY	WWYY	WWYy	WwYY	WwYy
Wy	WWYy	WWyy	WwYy	Wwyy
wY	WwYY	WwYy	wwYY	wwYy
wy	WwYy	Wwyy	wwYy	wwyy

2- recessive epistatis (9:3:4)

Here the homozygous recessive allele (bb) for a gene masks the expression of the dominant allele (A-) for another gene ("**bb**" suppress "**A**").

Epistasis due to recessive genes is called recessive epistasis. In mice albinism (white coat) is produced by a recessive gene aa. There is a different gene B which in the dominant state (BB and Bb) produces grey coat colour called agouti, and when recessive (bb) leads to black coat colour.

The recessive gene for albinism (aa) is found to be epistatic to the gene for agouti (BB and Bb), and also to its recessive, homozygous allele (bb) for black. The presence of the dominant allele (AA) of the epistatic gene allows expression of gene B so that agouti (BB and Bb) and black (bb) coat colours can be produced



3- dominant and recessive epistsis (suppressor genes) (13:3) :

the dominant form of a gene inhibits the expression of another gene This so-called **suppressor genes**. A dihybrid cross between two heterozygous parents will produce an F2 ratio of 13:3.

EXAMPLE / **the feather colour of chickens** the presence of the dominant allele I inhibits the expression of a second gene, C, coding for colour . Therefore:

A-B-, A-bb, aabb same phenotype (13)

aaB- different phenotype (3)

In other words,

C- = col our **cc = white**

I- = inhibitor **ii = no effect**

- **P :** CCII (White Leghorn) × ccii (White Plymouth Rock)

↓

- **F_1 :** CcIi (white)

	CI	**Ci**	**cI**	**ci**
CI	CCII (white)	CCIi (white)	CcII (white)	CcIi (white)
Ci	CCIi (white)	CCii (colored)	CcIi (white)	Ccii (colored)
cI	CcII (white)	CcIi (white)	ccII (white)	ccIi (white)
ci	CcIi (white)	Ccii (colored)	ccIi (white)	ccii (white)

Chickens will only be coloured if the inhibitor gene is homozygous recessive (ii) and there is at least one C allele. Its genotype would therefore be either iiCC or iiCc. The chickens will however be white if the inhibitor gene is present, or if the dominant allele for colour is not present. Possible genotypes for white chickens are therefore I-C- or I-cc or iicc.

4- duplicate dominant epistasis (duplicate gene) (15:1)

In this case of epistasis The non allelic dominant genes will expression one phenotype . i.e.

A-B- , A-bb , aaB- same phenotype (15)

aabb different phenotype (1)

EXAMPLE / **the shepherd's purse (seed capsule shape)**

there are two shapes (triangle and ovoid)

15/16 = Triangular

1/16 = ovoid (topshaped)

AABB × aabb

Triangular Ovoid

AaBb × AaBb

Triangular ↓

AB = 9 = Triangular

Ab = 3 Triangular

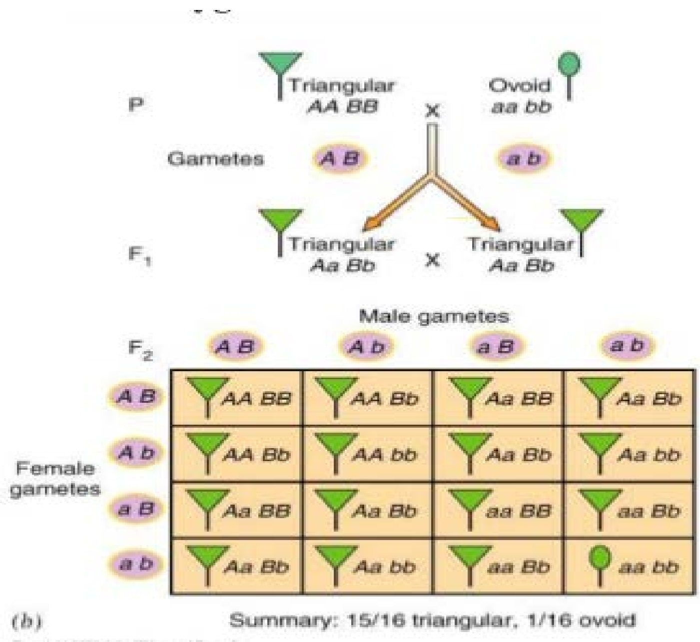
aB = 3 Triangular

ab = 1 Ovoid (top shaped)

15 : 1

Triangular : Ovoid

	AB	Ab	aB	ab
AB	AABB Triangular	AABb Triangular	AaBB Triangular	AaBb Triangular
Ab	AABb Triangular	AAbb Triangular	AaBb Triangular	Aabb Triangular
aB	AaBb Triangular	AaBb Triangular	aaBB Triangular	aaBb Triangular
ab	AaBb Triangular	Aabb Triangular	aaBb Triangular	aabb ovoid



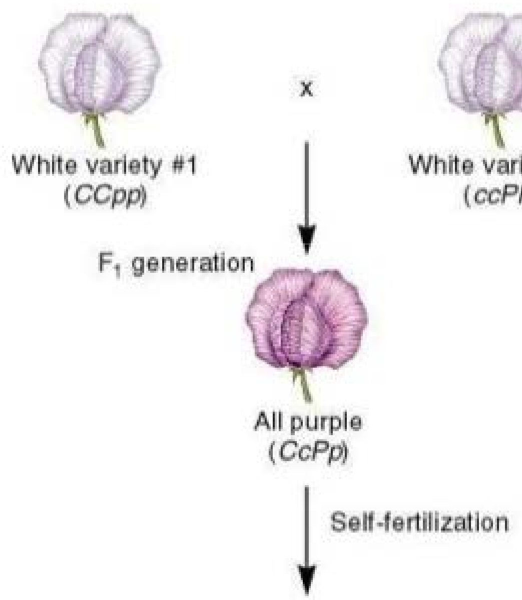
5- duplicate recessive epistasis (complementary genes) (9:7)

Involves two pairs of non-allelic genes. When dominant forms of both the genes involved in **complementary** gene **interaction** are alone have same phenotypic expression. But, if they are present in combination, yield different phenotypic effect and the results in a ratio of (9:7)

A-B- same phenotype (9)

A-bb, aaB- , aabb different phenotype (7)

EXAMPLE / **Sweet pea flower color** there are two colors (purple and white)



	CP	Cp	cP	cp
CP	CCPP Purple	CCPp Purple	CcPP Purple	CcPp Purple
Cp	CCPp Purple	CCpp White	CcPp Purple	Ccpp White
cP	CcPP Purple	CcPp Purple	ccPP White	ccPp White
cp	CcPp Purple	Ccpp White	ccPp White	ccpp White

9 C_P_ : 3 C_pp :3 ccP_ : 1 ccpp

purple (9 C_P_) ; white (3 C_pp :3 ccP_ : 1 ccpp)

6- incomplete duplicate epistasis (9:6:1)

mean that if a dominant allele is missing for one gene or the other, the phenotype will be the same, and that at least one dominant allele for each gene results in distinct phenotype, and that for recessive genes results in phenotype different from the other.

A-B- distinct phenotype (9)

A-bb, aaB- the same phenotype (6)

aabb different phenotype (1)

EXAMPLE / **Red coat color in Duroc-Jersey pigs** requires the presence of two dominant alleles, *R* and *S*. Pigs that have a dominant allele at only one of these genes are sandy colored while pigs that are homozygous recessive at both genes are white.

F1 RRbb X rrBB

↓

RrBb (hybrid red)

RrBb X RrBb

F2 9 R-B- red : 6 [R-bb , rrB-] sandy : 1 rrbb white

♀ \ ♂	RB	Rb	rB	rb
RB	RRBB Red	RRBb Red	RrBB Red	RrBb Red
Rb	RRBb Red	RRbb Brown	RrBb Red	Rrbb Brown
rB	RrBB Red	RrBb Red	rrBB Brown	rrBb Brown
rb	RrBb Red	Rrbb Brown	rrBb Brown	rrbb White