INTER ACTION OF GENE

INTRODUCTION → Some times after the discovery of mendel's Law, it was observed that the law of segregation is not applicable universally. There are a number of cases where the proportion of 3:1 or 9:3:3:1 is not obtained in f_2 generation. This type of inheritance is supposed to occur due to two or more than two pairs of genes. The expression of which interact and influence the characters. In all such cases, phenotypically, the ratio is radiofied but law of heridity remains the same. Some important forms of gene expression and interaction are as follows →

(I) Complementary type — 9:7
(II) Supplementary type — 9:4:3
(III) Epistatis ——— 12:3:1
(IV) Inhibitory ——— 13:3
(V) Duplicate ——— 15:1
(VI) Lethal ——— 0:2:1
(VII) Polymerism ——— 9:6:1

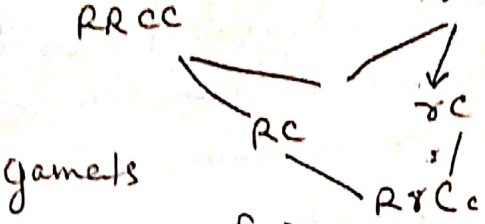
Complementary type → When red corn are crossed with white grain corn. we get red corn in f_1 generation but in f_2 we get supresing ratio of 9:7. It was supposed due to a complementary factor.

Ex → If we represent Red corn as RRCC
RR = Red dominent color.

cc – complementary factor

Red corn × white corn

RRcc × rrcc



F_1

F_2 →	Rc	Rc	rc	rc
Rc	RRcc coloured	RRcc coloured	Rrcc coloured	Rrcc coloured
Rc	RRcc coloured	RRcc white	RRCc coloured	RrCc white
rc	RrCc coloured	Rrcc coloured	rrCc white	rrCc white
rc	RrCc coloured	Rrcc white	rrCc white	rrcc white

from the above cross it becomes clear that

① offspring no 1, 2, 3, 4, 5, 7, 9, 10, 13 are red because they contain at least on dominent R and one dominent c.

② offspring no 6 though possess dominent gene R but it is colourless, because the complementary factor C (or dominent gene c) responsible to produce the enzyme which would oxidise the chromosome R is lacking.

③ Supplementary type → (9:3:4) → The supplementary factor is due to the pairs of supplementary genes that interact in such a way that one dominent will produce its effect where as the second can only produce its character in the presence of the first.

Ex – when we cross the black rat with

ordinary albino, all the F_1 hybrids are of the agouti which is wild ancestor type. when the f_1 individual are self fertilized the F_2 produces 9 agouti, 4 albino, 3 black. The black parent contains a gene c which is responsible for the development of the color. Agouti color is the result of interaction of gene c gene A, the latter coming from the albino parent gene A how ever which alone is unable to develop any color.

Black rat — CC aa

Albino rat — cc AA

$F_1 \rightarrow$ CcAa - Agouti

$F_2 \rightarrow$	CA	Ca	cA	ca
CA	CCAA Agouti	CCAa Agouti	CcAA Agouti	CcAa Agouti
Ca	CCAa Agouti	CCaa Black	CcAa Agouti	Ccaa Black
cA	CcAA Agouti	CcAa Agouti	ccAA Albino	ccAa Albino
ca	ccAa Agouti	Ccaa Black	ccAa Albino	ccaa Albino

Ratio – Agent : Albino : Black = 9 : 4 : 3

(3) Epistatis [12 : 3 : 1] Sometimes it so happen that two independent gens effect the same trait in an organism and one gene have ever masks the effect of the other the gene that masks the effect is known as

Epistatic and whose expression is prevented is called 'Hypostatic'.

Let us now cross the Brown and White dog.

White × Brown

BBII bbii

$F_1 \rightarrow$ BbIi

Here I mask the effect of gene B'

$F_2 \rightarrow$

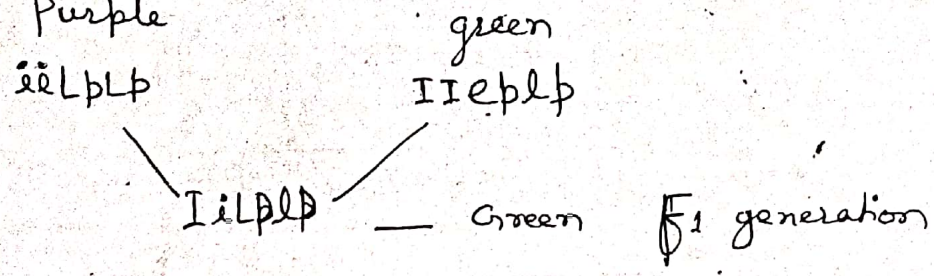
	BI	Bi	bI	bi
BI	BBII	BBIi	BbII	BbIi
Bi	BBIi	BBii	BbIi	Bbii
bI	BbII	BbIi	bbII	bbIi
bi	BbIi	Bbii	bbIi	bbii
				Brown

White : Black : Brown - 12:3:1

(4) Inhibitory factor → 13:3 → The inhibitory factor can be defined that it self has no phenotypic effect, but when it is present in the dominent condition it prevent or inhibits the expression of another independent gene present in another chromosome. When we pay attention East's experiment we get the ratio of 13:3.

In rice purple pigment (Lp) of leaf is dominent over green (lp). When the plants with purple leaves are crossed with those having green leaves, all green plants are produced in F_1 generation, Hence the

inhibitory factor (I) inhibits the effect of LP and due to which leaves become green. In F_2 generation the ratio of green & purple is 13:3 respectively.



$F_2 \rightarrow$

	ILP	ILp	iLp	ilp
ILP	IILLPP green	IILpLp green	IiLPLp green	IiLpLp green
ILp	IILLPp green	IILpLp Purple	IiLpLP green	IiLpLp Purple
iLp	IiLLPP green	IiLpLp green	iiLPLP green	iiLPLp green
ilp	IiLpLp green	IiLpLp purple	iiLpLP green	iiLpLp green

Ratio – Green : Purple = 13:3

(v) Duplicate factor (15:1) → This ratio is also due to the interaction of genes which takes place when two or more genes situated on different chromosome effect the single trait. This is due to the presence of duplicate genes. It has been experimentally found that when varities, having white and yellow endosperm of maize are crossed, all the plants in F_1 generation have yellow coloured endosperm. And when they are self fertilized, a ratio of 15 yellow : 1 white is found in

	YB	Yb	yB	yb
YB	YYBB	YYBb	YyBB	YyBb
Yb	YYBb	YYbb	YyBb	Yybb
yB	YyBB	YyBb	yyBB	yyBb
yb	YyBb	Yybb	yyBb	yybb white

Ratio – yellow : white = 15:1

Lathal factor [0:2:1] → Effect of lethal genes have been recorded in mouse which have yellow body color. It has been found that the yellow colour is dominent over only other colour (Black, Brown etc) in mouse.

Yellow mouse have allowed to mat and it was found that the ratio in F_1 was 2 yellow, 1 black why it so? The reason may be understood if we denote yellow mouse by Yy (Black or brown where y is dominent and y is recessive) in F_1 we will get the offspring of the genotype YY, Yy, Yy, yy.

The yellow with double case of dominent y genes dies because double y gene produce lethal effect.

The whole can be tabulated as follows —

Yellow × yellow

Yy × Yy

→	Y	y
Y	YY Died	Yy yellow
y	Yy yellow	yy black

Ratio : yellow : black = 2:1

POLYMERISM (9:6:1) → In this case out of the two genes only one of them is present, the phenotypic expression is the same, when both one present together they antisibied the character to much extent.

This factor can be well understand by taking the two different fruits shape, of cucurbita pepo, the spherical and disc. The spherical behave as recessive to disc form.

Spherical × Spherical

AAbb × aaBB

↓

AaBb disc (F1 generation)

	AB	Ab	aB	ab
AB	AABB Disc	AABb Disc	AaBB Disc	AaBb Disc
Ab	AABb Disc	AAbb spherical	AaBb Disc	Aabb spherical
aB	AaBB Disc	AaBb Disc	aaBB spherical	aaBb spherical
ab	AaBb disc	Aabb spherical	aaBb spherical	aabb cylindrical

Ratio = Disc : spherical : cylindrical :: 9 : 6 : 1