Gamete's formation

Types of Gametes → 2^n

n → no of heterozygous condition.

Aa → Monohybrid

AABBCc → also is not Monohybrid.

AA	Aa	AABb	AaBb	AABBCc	AABbCc	AaBbCc
n = 0	n = 1	n = 1	n = 2	n = 1	n = 2	n = 3
No of Gametes $2^0 = 1$	$2^1 = 2$	2	2	2	4	8
A ①	A (½) a (½)	B–A → AB b → A → Ab	A < B → AB, b → Ab a < B → aB, b → ab	~~A B~~ ~~b A B~~ A → B < C, c	A < B < C, c; C, c b < C, c; C, c	A < B < C, c; C, c b < C, c; C, c a < B < C, c; C, c b < C, c; C, c

Fork line Method

2) aBDd rt
3) AbDRyt
4) aBdRT

Dihybrid Cross (Study of inheritance of two characters at a time

Mendel perform these crosses to know the presence of any kind of interaction among character during inheritance.

but he never performed all 21 types of dihybrid cross from 7 character.

♂ Round & Yellow × ♀ Wrinkled & Green

RRYY × rryy

R Y × r y

F1 → RrYy (Round Yellow)

1. Selfing

RrYy × RrYy

Gametes

RY	Ry	rY	ry
RY	Ry	rY	ry

♀ \ ♂	RY (1/4)	Ry (1/4)	rY (1/4)	ry (1/4)
RY (1/4)	RRYY	RRYy	RrYY	RrYy
Ry (1/4)	RRYy	RRyy	RrYy	Rryy
rY (1/4)	RrYY	RrYy	rrYY	rrYy
ry (1/4)	RrYy	Rryy	rrYy	rryy

4 → 1
3 → 4
2 → 6
1 → 4
0 → 1

9 → R_Y_ ⇒ Round Yellow

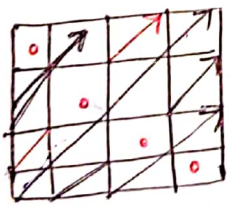
3 → R_yy ⇒ Round Green

3 → rrY_ ⇒ wrinkled Yellow

1 → rryy → wrinkled green

Phenotypic Ratio

9 : 3 : 3 : 1



RRYY RRYy RrYY RrYy

1 2 2 4

RRyy Rryy rrYY rrYy rryy

1 2 1 2 1

• → Homozygous for both characters

1 : 2 : 2 : 4 : 1 : 2 : 1 : 2 : 1

or

1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

Q. In the F_2 generation of Dihybrid Cross find out the Probability of offspring ① which are homozygous for both character $\frac{1}{16} = \frac{1}{4}$

② which are heterozygous for both character / dihybrid offspring $\frac{4}{16} = \frac{1}{4}$

2nd Generation

it is for any cross

③ which are homo for one & hetero for other $= \frac{8}{16} = \frac{1}{2}$

④ which have parental Genot phenotype $= \frac{10}{16}$

⑤ " " Recombinant phenotype $= \frac{6}{16}$

⑥ which have phenotype as F_1 $\rightarrow \frac{9}{16}$

⑦ " " parental Genotype $= \frac{2}{16}$

⑧ " " new " $\rightarrow \frac{14}{16}$

Ratio b/w parental phenotype & new phenotype $= 10:6$ or $5:3$

Ratio b/w " Genotype & new Genotype $= 2:14$ or $1:7$

Conclusion Postulate - IV → Law of independent Assortment

When Inheritance of two or more character is studied simultaneously than each character will assort out of independently from other character in mono hybrid pattern to next generation.

9 R Y] 12 R
3 R G
3 W Y] 4 W
1 W G

} 12 : 4
3 : 1

Acc to assortment, a dihybrid cross is a multiple of two mono hybrid crosses.

(3:1) (3:1)
↓
9 : 3 : 3 : 1

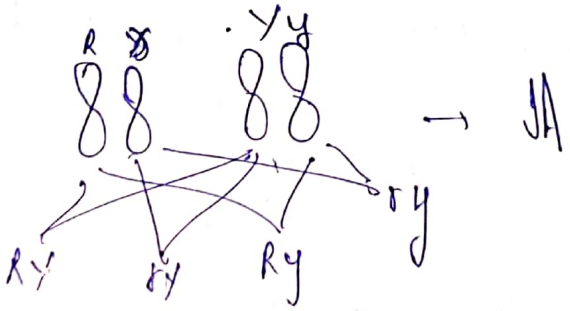
or (1:2:1) (1:2:1)
↓
1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1

This law is applicable only when genes of both characters must be present on separate homologous pairs of chromosome.

Independent Assortment — independent inheritance of non allelic genes present on different chromosome

where as linkage — Similtaneously inheritance of non-allelic genes present on same chromosome

Segregation → independent sep. of Allelic gene



→ DA

→ linkage

now R can't come with y.
segregation also occur.

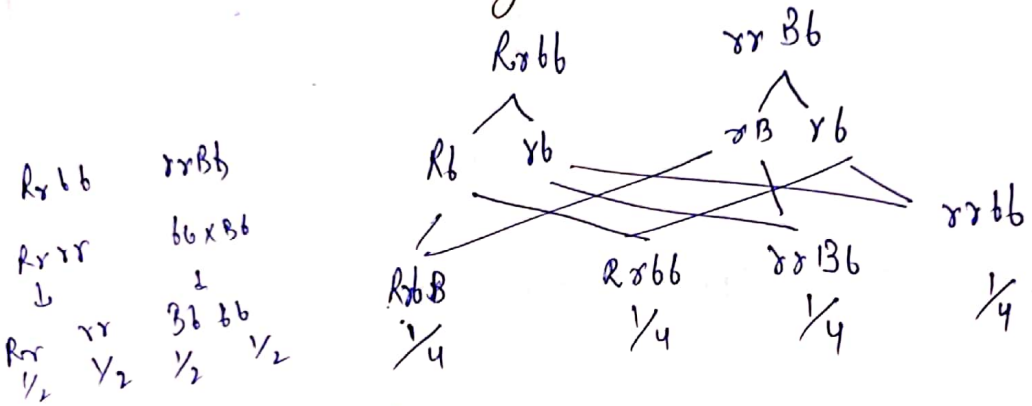
If Mendel would do all 21 Crosses
than he will not find Independent Assortment.

In Human beings Black hairs are dominant over red hair & Brown eyes are Dominant over Blue eyes. If a man with Black hair & Blue eye (RrBb) marries with a woman with Red Hair & Brown eyes (rrBb) than what will be the probability of following combination in their offsprings ① Black hair & Brown eyes

② Black hair & Blue eyes

③ Red hair & Brown eyes

④ Red hair & Blue eyes.



Rrbb rrBb

Rrrr 1

↓ rr Bb bb

Rr rr 1/2 1/2 1/2

1/2 1/2

Ans In a dihybrid cross, the progeny of AABb, AABb, AaBB Aa Bb occurs in ratio 1.

(AABB × aabb)

AB ab

AaBb × AaBb

AA Aa aa BB bb Bb

AABB AABb AaBB AaBb

AABB → 1/4 × 1/4 → 1/16

AABb → 1/4 × 2/4 = 2/16

AaBb → 2/4 × 2/4 = 4/16

AaBB → 2/4 × 1/4 = 2/16

⇒ 1 : 2 : 2 : 4

If total 2400 offsprings have been obtain in F_2 generation of a trihybrid cross then what will be the no of offsprings having tall bb cc.

$F_1 \rightarrow AaBbCc \times AaBbCc$

AA aa Aa BB Bb bb CC cc Cc

$\frac{1}{4}$ $\frac{1}{4}$ $\frac{2}{4}$

$Aabbcc$

$\frac{2}{4} \times \frac{1}{4} \times \frac{2}{4} \Rightarrow \frac{4}{64}$ ~~600~~ 150

Total $\Rightarrow \frac{1}{16} \times 2400$

By

Trihybrid cross

$n = 3$

Imp. formulae

Types of Gametes $\rightarrow 2^n$ — 8

only in selfing (both parents of Genotype same):

- Types of phenotype $\rightarrow 2^n$ — 8
- Types of Genotype $\rightarrow 3^n$ — 27
- Total possible Zygotic Combination $\rightarrow 4^n$ — 64

$n \rightarrow$ no of heterozygous

AABb AaBb

↓ ↓

2 gamete 4 gametes

↓

8 Zygotic Combination.

Reason for Success of Mendel

* Selection of Pea plant
* Study of one or few character at a time
* Use of Mathematics & Statistics
* Use of Pure parent for Crosses
* Quantitative analysis of Qualitative character.

Post Mendelism

- starts after the rediscovery of Mendel's work (1900 onwards)

Gene Interaction

I) Allelic Gene Interaction | One gene interact | Intragenic

II) Non Allelic Gene Interaction | Two gene | Intergenic

Genotypic ratio remain same b/c no change in Genotype.

Majority of Gene Interaction occurs at product level so only phenotypic ratio will change & Genotypic ratio remain same.

I) Allelic Gene Interaction

1) Incomplete Dominance.

In this, Dominant allele of a character is not fully dominant over recessive allele. so in heterozygous Condⁿ, an intermediate form appears.

Thus, F_1 resembles none of the Parents.

It is first discovered by Carl Correns

in Mirabilis jalapa

Flower Colour ← Red, Pink, White

Red (RR) × White (rr)

↓

F_1 Rr

Pink

↓ selfing

F_2 → RR, Rr, Rr, rr

Red, Pink, White

PR → 1 : 2 : 1

GR → 1 : 2 : 1

eg Snapdragon | Dog flower plant

(Antirrhinum majus)

→ Feather colour in Andalusian fowl.

Black × White

↓

Greyish Blue.

Ra → Peiotropic Gene < seed shape (Complete dominance)
size of starch grain (Incomplete dominance)

RR
Round
large sized
starch grain

rr
Wrinkled
small size starch grain

Rr
Round
Intermediate sized
starch grain

Qn In Mirabili's plant, tallness is completely dominant over dwarfness while Red flowers are incompletely dominant over white flowers. if a Pure Tall & Red flowered plant is crossed with Dwarf & white flowered plant find out the following in F2 gen.

① PR ② GR ③ Probality of offspring having phenotypic ratio (16)

RRTT x rrtt

RrTt Pink & Tall

selfing

long Method

RT RT RT RT
RT RRTT RRTt RrTT RrTt
Rt RRTt RRtt RrTt Rrtt
rT RrTT RrTt rrTT rrTt
rt RrTt Rrtt rrTt rrtt

RT RT RT rt
Rt rT rt
RT Rt rT rt

RT RD RD RT
3 : 1 : 2 : 6

WT WD
3 : 1

TD RP W
PR → (3 : 1) (1 : 2 : 1)
3 : 6 : 3 : 1 : 2 : 1
TDR TDP TDW RDP RDW WDW

GR → 1 : 2 : 1 : 2 : 4 : 2 : 1 : 2 : 1 → remaining same

Incomplete Dominance is actually monogenic Quantitative inheritance.

2) Co-Dominance — another exception of Mendle's point of Domi. nance.

Both the alleles of a character are equally dominant do in heterozygous Gen both will express side by side.

No intermediate form appear.

eg Coat Colour in Cattle

Black B_1B_1 White B_2B_2

↓

Roan Cattle → F_1

B_1B_2

↓ Interbreeding

♂ B_1B_2 × B_1B_2 ♀

	B_1	B_2
B_1	B_1B_1 (Black)	B_1B_2 (Roan)
B_2	B_1B_2 (Roan)	B_2B_2 (White)

PR → 1 : 2 : 1

GR → 1 : 2 : 1

AA
BB
AB

I^AI^A
I^AI^o
I^BI^B
I^BI^o
I^AI^B
I^oI^o

eg AB Blood Group in Human I^AI^B

MN Blood Group in Human

- L^M → form M antigen
- L^N → form N "

eg Sickle Cell anaemia in Human → Carrier / Hetero Hb^AHb^S is have both type of RBC.

Hb^A Hb^S

↓ ↓

Normal Haemo Abnormal Haemo

↓ ↓

Normal RBC Sickle shaped RBC

What will be the F_2 phynotypic ratio of a Dihybrid Cross in which one character shows Incomplete Dominance & other shows ~~Complete~~ Co-Dominance.

PR of ID → 1:2:1

PR of CD → 1:2:1

Ans → (1:2:1) (1:2:1)

PR → 1:2:1:2:4:2:1:2:1

Genotypic ratio → 1:2:1:2:4:2:1:2:1.

Que F_2 generation in a mendelian Cross shows Similar PR & GR as 1:2:1 it represent a case of

① Monohybrid Cross with Complete Dominance

② " " " Incomplete "

③ Codominance

④ Dihybrid Cross.