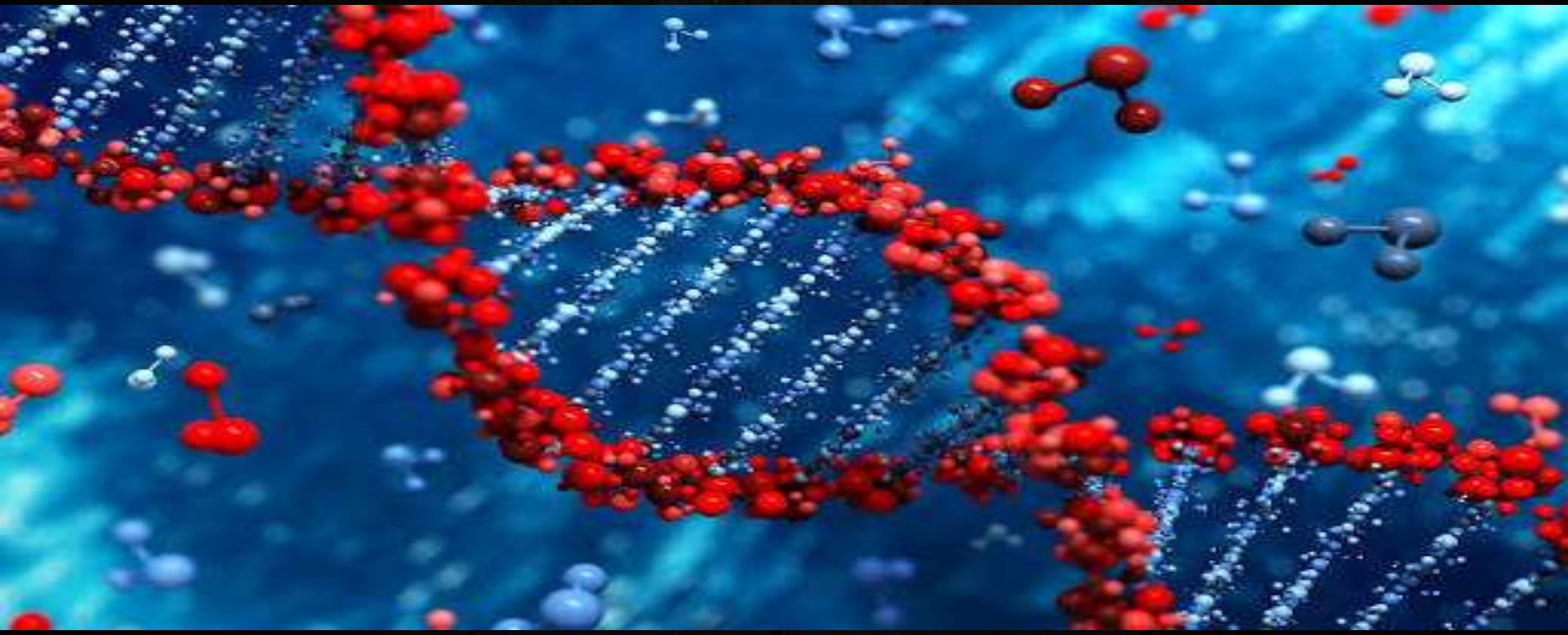
INCOMPLETE DOMINANCE VS CO-DOMINANCE



PRESENTED BY-
BIPASHA ROY (17/BBT/24)
DEBAJIT ATREYA (17/BBT/25)

CONTENTS:

INTRODUCTION :
Review of Mendel's Principles

- Genes are passed parents → offspring; get one allele from each parent
- During Meiosis, the alleles for a gene segregate from each other.
- During Meiosis, genes independently assort with each other.

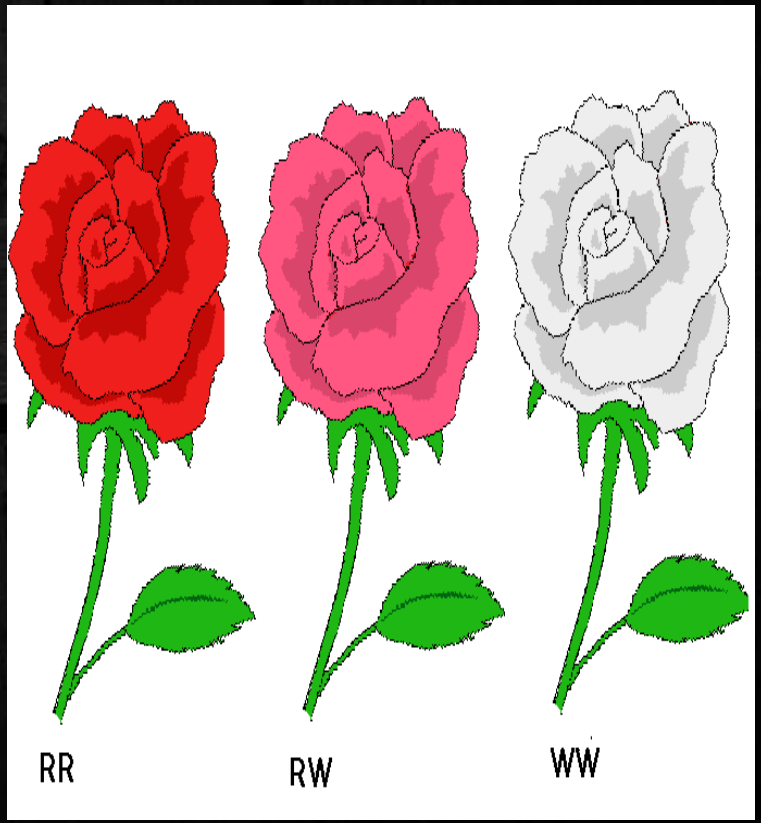
Incomplete Dominance

•Incomplete dominance is when a dominant allele, form of a gene, does not completely mask the effects of a recessive alleles, and the organism's resulting physical appearance shows a blending of both alleles . It is also called semi dominance or partial dominance.

Example of Incomplete Dominance

ROSES -

- For roses, the allele for red color is dominant over the allele for white color , but heterozygous roses, which have both alleles , are pink.



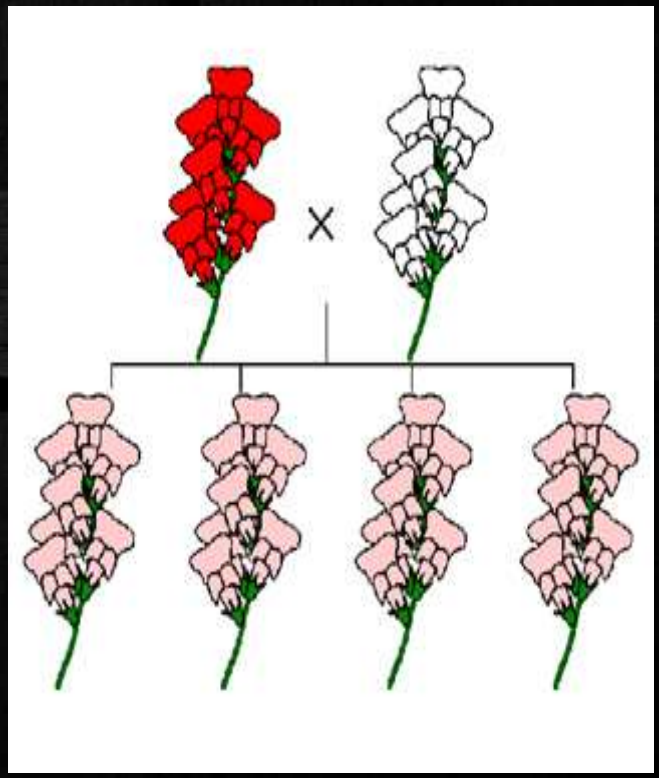
Example of Incomplete Dominance

- Snapdragons-

As an example, incomplete dominance is seen in cross pollination experiments between red and white snapdragon plants. In this monohybrid cross, the allele that produces the red colour (R) is not completely expressed over the allele that produces the white colour (r). The resulting offspring are all pink.

The genotypes are :

RED (RR) X white (rr) = Pink (Rr).



Then the first filial (F1) generation consisting of all pink plants is allowed to cross

Pollinate, the resulting plants (F2 generation) consist of three phenotypes {1/4 Red:
1/2Pink(Rr): ¼ White(rr)}.
The phenotypic ratio is 1:2:1.

- When the F1 generation is allowed to cross-pollinate with true-breeding red plants, the resulting F2 plants consist of red and pink phenotypes {1/2 Red (RR) : 1/2 Pink (Rr)}.
- When the F1 generation is allowed to cross-pollinate with true breeding white plants , the resulting F2 plants consist of white and pink phenotypes {1/2 White (rr) : 1/2 Pink (Rr)}.

The phenotypic ratio is 1:1.

WHY does “Incomplete Dominance” occur ?

- Incomplete dominance may occur because neither of the two alleles is fully dominant over the other , or because the dominant allele does not fully dominate the recessive allele .

- This results in a phenotype that is different from both the dominant and recessive alleles, and appears to be a mixture of both.

CODOMINANCE

Some genes have alleles that are both expressed in the heterozygote individuals

ODWS

Shorthorn Cattle

- Co- dominance
- Homozygous red (RR)
- Homozygous white (WW)

The offspring of will have both red and white hairs (RW)

The offspring are heterozygous and called “roan”

Unusual proportions

- In codominance, heterozygotes have their own phenotype
- This gives rise to different proportions amongst offspring of some genetic crosses

Phenotypes Sickle cell trait x Sickle cell trait

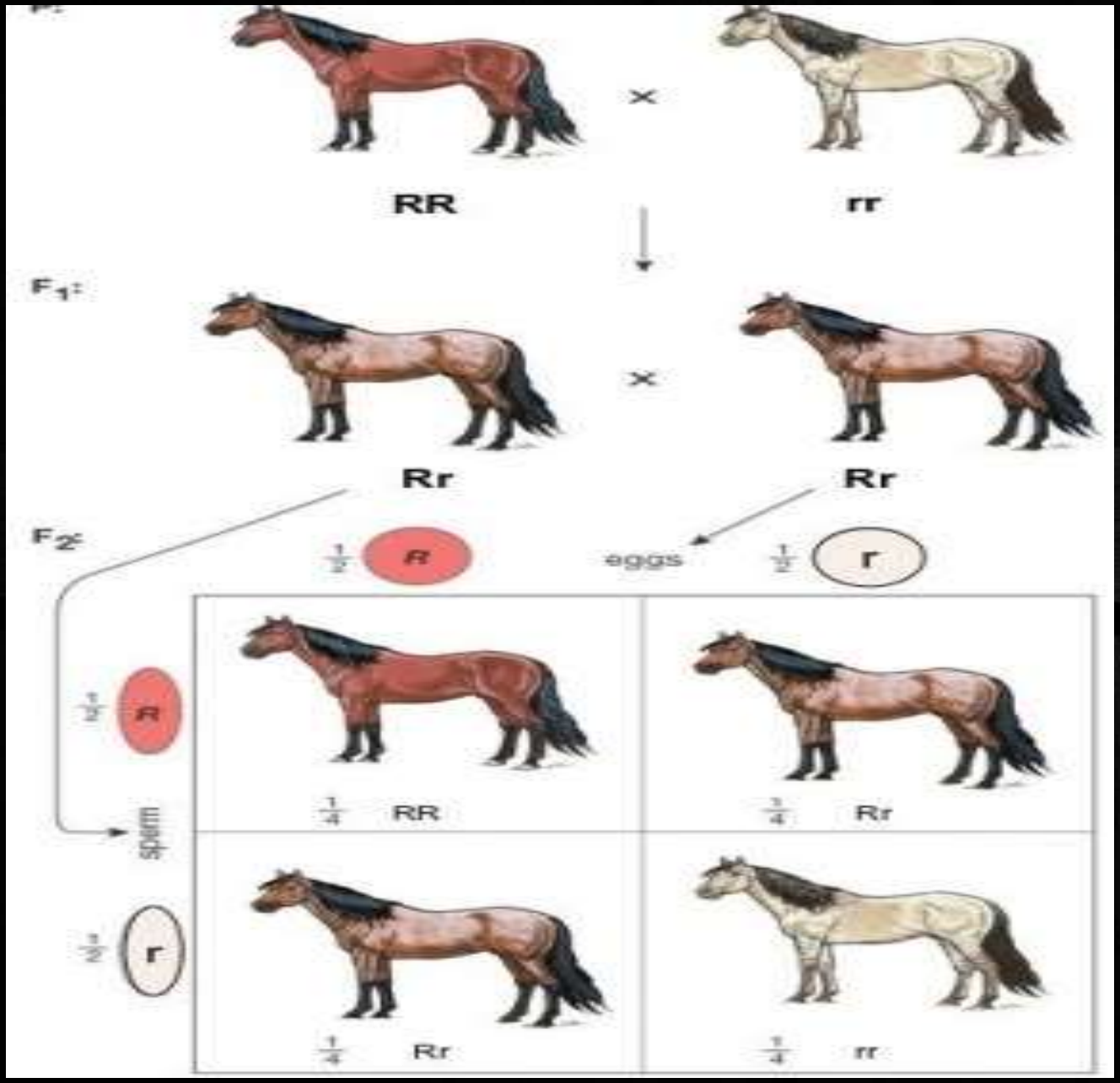
Genotypes Hb^NHb^S Hb^NHb^S

Gametes Hb^N Hb^S Hb^N Hb^S

	Hb^N	Hb^S
Hb^N	Hb^NHb^N	Hb^NHb^S
Hb^S	Hb^NHb^S	Hb^SHb^S

Offspring	Normal	Sickle cell trait	Sickle cell anemia
Proportions	**25%**	**50%**	**25%**

Roan Horse



Sickle- Cell Anemia

- Co- dominance
- Caused by an abnormal

Hemoglobin, the protein that red blood cells use to carry oxygen

Normal hemoglobin is (RR)

Sickle Cell shaped blood cells (SS)

People who are carriers (heterozygous) for the disease there is a mixture of both normal and sickle ce

Problem: Codominance

- Show the cross between an individual with sickle-cell anemia and another who is a carrier but not sick.

GENOTYPES:

- NS (2) SS (2)
- ratio 1:1

PHENOTYPES:

- carrier (2); sick (2)
- ratio 1:1

BLOOD TYPING

- Blood types are A, B, O, and AB.
- AB blood is a co-dominant trait.
- Both the A blood and the B blood need to be dominant in order to make a combination of co-dominant blood types, which is AB.
- ..... IA IA IA i

Blood Type	Genotype		Can Receive Blood From:
A	$i^A i$ $i^A i^A$	AA AO	A or O
B	$i^B i$ $i^B i^B$	BB BO	B or O
AB	$i^A i^B$	AB	A, B, AB, O
O	$i\ i$	OO	O

IA IB	IA IB
IA IB	IA IB

IA IB	IB i
IA i	ii

Differences between Incomplete dominance and Co-dominance

- Incomplete dominance
  - Effect of one of the two alleles is more conspicuous.
  - It produces a fine mixture of the expression of two alleles.
  - The effect in hybrid is intermediate of the two alleles.
  - The expressed phenomenon is new. It has no allele of its own.
- Co-dominance
  - Effect of both the alleles are equally conspicuous.
  - There is no mixing of the expression of two alleles.
  - Both the alleles produce their effect independently.
  - The expressed phenotype is combination of two phenotypes and their alleles.

- Incomplete dominance

- The incomplete dominant allele has quantitative equivalent effect.
- Examples- *MIRABILIS* JALAPA ; SNAPDRAGON

- Co-dominance

- The quantitative effect is absent.
- Examples- A and B blood group alleles of human ; Roan character in cattle.

Think

- Let's say there are two alleles for the hair color trait- red and blue
  - What would be the resulting phenotype of a heterozygous pair if the alleles showed incomplete dominance?
    - A. Red
    - B. Blue
    - C. Purple
    - D. Red and Blue patches

Let's Stop and Think…

- Let's say there are two alleles for the hair color trait- red and blue

- What would be the resulting phenotype of a heterozygous pair if the alleles showed codominance?
  - A. Red
  - B. Blue
  - C. Purple
  - D. Red and Blue patches

Conclusion-

IN INCOMPLETE DOMINANCE IT IS CLEAR THAT THE DOMINANT ALLELE DOES NOT SUPRESS THE RECESSIVE ALLELE AND THUS BLENDING OCCURS AND AN INTERMEDIATE IS FORMED. IT IS A NON-MENDELIAN TRAIT.

IN CODOMINANCE THE CASE IS NOT THAT LIKE AS INCOMPLETE DOMINANCE. HERE BLENDING DOES NOT OCCUR RATHER AN ANOTHER PRODUCT IS FORMED WHICH IS NEITHER RECESSIVE NOR DOMINANT AND CONTAINS GAMETS OF BOTH DOMINANAT AND RECESSSIVE GAMETS. AND ALL THE PRODUCTS COME IN PROPORTION.