







Mendel's mechanism

02 October 2023







Predicting genotype and phenotype frequencies

- ▶ 2 alleles for flower colour
 - ▶ B (dominant)
 - ▶ b (recessive)
- ▶ 3 possible genotypes
 - ▶ BB
 - ▶ Bb
 - ▶ bb
- ▶ 2 possible phenotypes
 - ▶ Pink (BB, Bb)
 - ▶ White (bb)

		 pollen ♂	
		B	b
 pistil ♀	B	 BB	 Bb
	b	 Bb	 bb

Predicting genotype and phenotype frequencies

- ▶ Punnett squares can predict genotype and phenotype frequencies
- ▶ Summary of all possible combinations of maternal and paternal alleles
- ▶ Predict probabilities of different genotypes given a cross

		 pollen ♂	
		B	b
 pistil ♀	B	 BB	 Bb
	b	 Bb	 bb

Dominant-recessive: BB vs Bb

Incomplete dominance: Snapdragon



Antirrhinum majus





- ▶ Flower colour shows incomplete dominance
 - ▶ Homozygous red ($C^R C^R$) makes red flowers
 - ▶ Homozygous white ($C^W C^W$) makes white flowers
 - ▶ Heterozygous ($C^R C^W$) makes pink flowers
- ▶ Letter C with superscript indicates neither allele is dominant

Incomplete dominance $C^R C^W$ vs $C^R C^W$

Phenotypes

- ▶ Red:
- ▶ Pink:
- ▶ White:

Codominance

Genotype	Phenotype
$I^A_$ ($I^A I^A$ or $I^A i$)	 Type A
$I^B_$ ($I^B I^B$ or $I^B i$)	 Type B
ii	 Type o
$I^A I^B$	 Type AB

Three total alleles

- ▶ 2 dominant (A, B)
- ▶ 1 recessive (i)

Dominant alleles caused by production of A or B antigens

Other antigens (Rh) determine positive or negative status

Codominant $I^A I^B$ vs $I^A I^B$

Phenotypes

- ▶ A:
- ▶ B:
- ▶ AB:
- ▶ O:

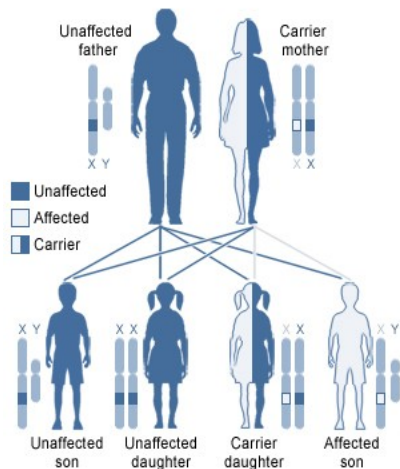
Codominant $I^A i$ vs $I^B i$

Phenotypes

- ▶ A:
- ▶ B:
- ▶ AB:
- ▶ O:

Haemophilia X-linked recessive

X-linked recessive, carrier mother



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- ▶ Absence of blood clotting proteins
- ▶ Dominant allele X^H , recessive X^h
- ▶ No allele on the Y chromosome















Sex-linked $X^H X^h$ vs $X^H Y$

Sex-linked $X^H X^h$ vs $X^H Y$

Phenotypes

- ▶ Unaffected:
- ▶ Affected:
- ▶ Carrier:

Dominant-recessive dihybrid cross

Characteristics of pea plants Gregor Mendel used in his inheritance experiments						
Seeds		Flower colour	Pod		Stem	
form	cotyledons		form	colour	position of inflorescences	size
 round roundish	 yellow	 white	 full	 yellow	 axial	 long
 wrinkled	 green	 violet-red	 constricted between the seeds	 green	 terminal	 short

Consider multiple phenotypes at once

Dominant-recessive dihybrid cross

Flower colour

- ▶ Purple (P)
- ▶ White (p)

Seed form

- ▶ Round (R)
- ▶ Wrinkled (r)

What are the different possible combinations of flower colour and seed form?















Dominant-recessive dihybrid cross: $PpRr$ vs $PpRr$

Dominant-recessive dihybrid cross: $PpRr$ vs $PpRr$

Phenotype ratios

- ▶ Purple Flowers, Round Seeds:
- ▶ Purple Flowers, Wrinkled Seeds:
- ▶ White Flowers, Round Seeds:
- ▶ White Flowers, Wrinkled Seeds:

Dominant-recessive trihybrid cross

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Colour (P, p), Seed (R, r), Size (L, l)

Dominant-recessive trihybrid cross: $PpRrLl$ vs $PpRrLl$