TOPIC 10.2: INHERITANCE

Unlinked Genes

The inheritance of two different genes / traits will occur *independently* provided the genes are on separate chromosomes

- This is because unlinked genes segregate independently during meiosis (random assortment of homologous pairs)

Mendel's Law of Independent Assortment

- Separation of alleles for one gene occurs independently of the separation of alleles for another gene

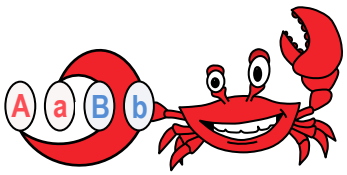
Dihybrid Crosses

Dihybrid crosses determine allele combinations of offspring for two genes that are **unlinked** (on different chromosomes)

- 2 genes × 2 alleles = 4 potential gamete combinations

Gamete combinations are calculated via the FOIL method:

- **F**irst (**A**a**B**b = AB)
- **O**utside (**A**aB**b** = Ab)
- **I**nside (A**a**B**b** = aB)
- **L**ast (A**a**B**b** = ab)



Once gamete combinations are identified, a punnett square is then used to calculate genotype and phenotype frequencies

Example:

Pea seed cross (heterozygous)

YyRr × YyRr

Y = yellow
y = green
R = round
r = wrinkled

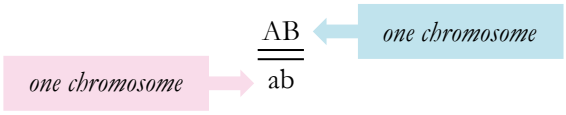
	YR	Yr	yR	yr
YR	YYRR	YYRr	YyRR	YyRr
Yr	YYRr	YYrr	YyRr	Yyrr
yR	YyRR	YyRr	yyRR	yyRr
yr	YyRr	Yyrr	yyRr	yyrr

Linked Genes

A linkage group describes a group of genes whose loci are on the same chromosome (i.e. linked genes)

- Linked genes will function as a single inheritable unit and will **not** follow the law of independent assortment

Linked genes are represented as pairs:



Linked genes can be separated (unlinked) by crossing over

- The novel allele combinations are called **recombinants**

Recombinant phenotypes will only be evident if crossing over has occurred and thus occur at **lower frequencies**

- Frequency increases the further apart the two genes are

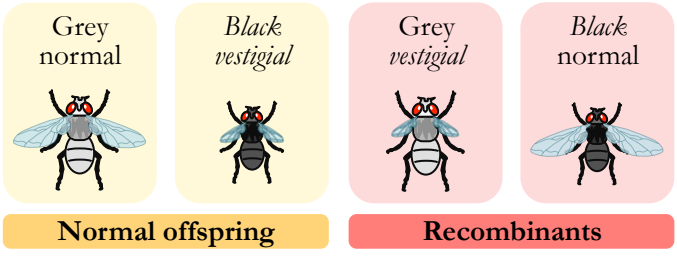
Linkage Studies

Thomas Morgan determined the concept of gene linkage via breeding experiments involving fruit flies *(Drosophila)*

Morgan identified a number of different traits that did not conform to Mendelian ratios and surmised the following:

- These traits represented linked genes *(on same chromosome)*
- Linked genes can be uncoupled via recombination, but such events are uncommon *(hence occur at low frequencies)*

Grey/normal wing (B.VG) × Black/vestigial wing (b.vg)



Polygenic Inheritance

Variation can be discrete (finite patterns) or continuous (normal distribution)

Monogenic traits are characteristics that are controlled by a single gene locus

- They therefore have a finite pattern of expression (discrete variation)

Polygenic traits are characteristics controlled by more than two gene loci

- They exhibit a bell-shaped distribution pattern (continuous variation)

Polygenic traits (e.g. human height) may also be influenced by environment