TOPIC 3.4: INHERITANCE PATTERNS

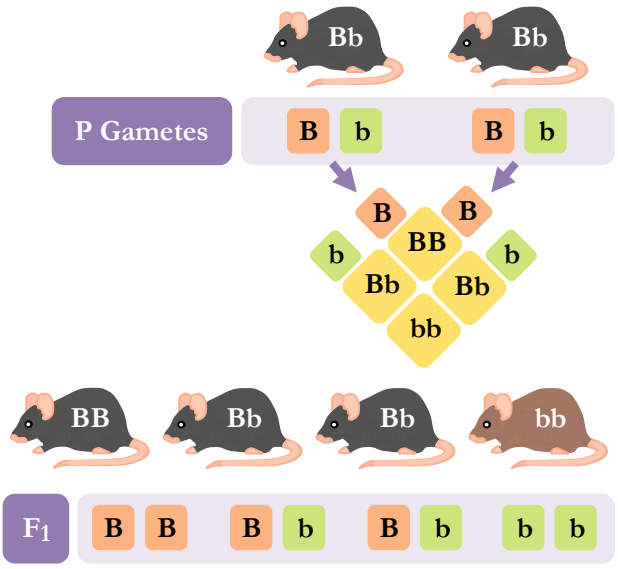
Monohybrid Crosses

A monohybrid cross determines the allele combinations for potential offspring for **one** gene only

- Crosses can be represented via the use of Punnett grids

Monohybrid crosses are calculated via the following steps:

- Designate letters to represent alleles (e.g. A, a)
- Identify genotype / phenotype of parents (P generation)
- Determine genotype of gametes (haploid)
- Work out gamete combinations with a Punnett grid
- Identify ratios of offspring (F_1 generation)



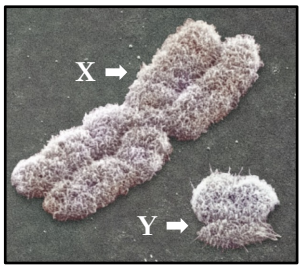
Sex Linkage

Sex linkage refers to when a gene is on a sex chromosome

- **I.e.** X or Y (all other chromosomes are autosomal)

Sex chromosomes (X/Y)

- **Y** chromosome is short and has few genes (<100)
- **X** chromosome is large with many genes (~2000)



Sex-Linked Traits

Sex-linked traits have altered inheritance patterns:

- Males have a higher rate of X-linked recessive conditions as they cannot mask the recessive allele (are hemizygous)
- Females can be **carriers** for X-linked recessive conditions (heterozygotes can carry the allele but not express it)

For X-linked conditions:

- *Recessive:* Affected mothers must have affected sons
- *Dominant:* Affected fathers must have affected daughters

Examples of X-linked recessive traits include:

- Haemophilia (cannot clot blood properly)
- Red-green colour blindness

Modes of Inheritance

A pedigree is a chart of genetic history over several generations

In a typical pedigree chart:

- Males are represented as squares, while females as circles
- Shaded symbols denote individual has a specified condition
- A horizontal line between man and woman represents mating
- Offspring numbered from left to right according to age

Autosomal Dominance:

- If both parents are affected by a trait and any offspring is not, the trait must be dominant (parents must be heterozygous)

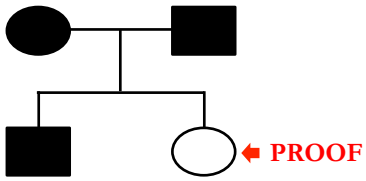
Autosomal Recessive:

- If neither parents is affected by a trait but any offspring is, the trait must be recessive (parents must be heterozygous)

Sex-Linked Traits:

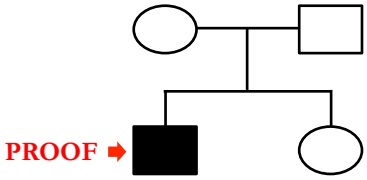
- No way to conclusively prove sex-linkage with a pedigree chart, but certain patterns may suggest the possibility

AUTOSOMAL DOMINANT



Not recessive as two affected parents could *not* have an unaffected offspring

AUTOSOMAL RECESSIVE



Not dominant as two unaffected parents could *not* have an affected offspring