Genetics Notes Chapter 4

Intro.

- The arrangement of genes on chromosomes is represented by a **chromosome map**.
- Gene positions are known as **loci**.
- Two types of chromosome maps:
- **Recombination-based maps:** map the location of genes that have been identified by mutant phenotypes in single-gene inheritance. (Focus of this chapter)
- **Physical Maps:** shows gene segment along a DNA molecule that makes up the chromosome.
- Used together to understand how genes at the molecular level influence the phenotype.

4.1

- When two genes are "**linked**" it means that the loci of those genes are on the same chromosome.
- Linked gene inheritance can be seen by looking at the phenotype of a dihybrid being testcrossed.
- If the progeny has two equally frequent non-recombinant classes resulting in more than 50% of the total progeny and two equally frequently occurring recombinant classes totaling in less than 50% then it can be deemed that the genes are linked.
- The few recombinants that are produced are produced during prophase of meiosis 1 in which **crossing over** occurs.
- During crossing over the chromosomes form a cross-shaped structure called a **chiasmata** and it is there where pieces sometimes break off from each other and switch.
- There are two type of allelic arrangements present on a pair of heterozygous homologous chromosomes:
- **Cis Conformation:** wild type alleles are on one chromosome and mutant alleles are on the other AB/ab.
- **Trans Conformation:** one wild type allele, one mutant allele on one chromosome and one wild type allele and one mutant allele on the other chromosome. Ab/aB
- Conventions that pertain to linkage:
- Alleles on the same homolog have no punctuation between them.
- A slash symbolically represents the two homologs.
- Alleles are always written in the same order on each homolog.
- Unlinked genes are separated by a semicolon
- In the book, genes of unknown linkage are separated by a dot.
- A crossover is the breakage of two DNA molecules at the same position and their rejoining in two reciprocal recombinant combinations.
- Crossing over only occurs between **non-sister chromatids** and occurs only after the chromatids have replicated (during the 4 chromatid stage not the 2 chromatid stage).
- Multiple chromatids can be involved in crossing over.

4.2

- The greater the distance between two genes the greater proportion of recombinants.
- This is because crossing over between the genes is more likely to occur.

- **One Genetic Map Unit (m.u.)** is the distance between genes for which one product of meiosis in 100 is recombinant.
- **Three point (trihybrid) test crosses** allow for genetic mapping and recombinant frequencies to be determined for these three genes.
- The event of one crossing over occurring makes it less likely for a second crossing over to occur this is called **interference.**

4.3

- Difference in DNA that don't necessarily affect the phenotype are called **molecular markers.**
- Differences in DNA at a single nucleotide are called **single-nucleotide polymorphisms.**
- Repetitive sections of DNA are called **simple sequence length polymorphisms.**
- Two types: minisatellite markers have the same repeated unit but different number of repeats. Microsatellite marker are repeats of even shorter sequences.

4.4

- Re-read over this section/ go over in class I didn't get it.

4.5

- Another chi-squared test you can review.

4.6

- A problem with double crossing over is that fewer recombinants are created and therefore we perceive these genes to be closer together on the chromosome than they are in reality.
- Mapping Functions are devised to relate recombinant frequencies with a map distance corrected for multiple crossovers. REVIEW THIS SECTION DON'T UNDERSTAND
- Can also use the Perkins formula when looking at fungi.

4.7

- A physical map is a map of the actual genomic DNA.
- Molecular markers on this and recombination maps can be used together to zero in on genes and their phenotypic functions.