3.7 Describe the work of Morgan that led to the understanding of sex linkage –

- **Thomas Morgan studied the breeding of fruit flies *(Drosophila melanogaster)* and identified sex linkage**

The Investigation:

- **Stage 1: During breeding of the flies, he observed one white-eyed male fly among the offspring of red-eyed parents. Morgan inferred that this white-eyed phenotype resulted from a mutant phenotype**
- **Stage 2: Morgan then mated (crossed) the mutant white-eyed male with a pure-breeding red-eyed female. The offspring (F_1) had red eyes, so Morgan concluded the red eye colour was dominant to white eye colour, which must have been recessive**
- **Stage 3: The offspring then reproduced (F_1 x F_1), finding 3 red eyes: 1 white eye in the F_2 generation (Mendelian Ratio), but all the white eyes were males**
- **Stage 4: Morgan then carried out reciprocal mating, using F_1 heterozygous red-eyed females with a white-eyed male and found equal numbers of white-eyed males and females → proved the white-eyed characteristic can be carried over to the females**

Conclusion → the allele for eye colour is sex-linked, and is only carried on the X-chromosome

Why the Fruit Fly was a suitable choice for the Investigation;

- **Required little space → easily contained in small glass containers**
- **Bred easily in captivity → efficient and economic**
- **Produce large numbers of offspring (can lay ~200 eggs just 2 weeks after mating)**
- **Males and females can be readily distinguished**
- **Have a relatively small number of chromosomes thus can be readily examined & analysed**

4) The structure of DNA can be changed and such changes may be reflected in the phenotype of the affected organism;

4.1 Describe the process of DNA replication and explain its significance –

- **DNA replication is the production of two identical double stranded molecules of DNA from one double helix molecule → ensures genetic material is copied exactly!**
- **DNA replication occurs before meiosis so that each cell receives one full and exact copy of the genes**

PROCESS OF DNA REPLICATION:

1. **There is a copy of a double-stranded DNA**
2. **An enzyme (helicase) unwinds the double stranded DNA into 2 single strands so that the complementary base pairs separate**
3. **An enzyme (primase) then creates RNA primers that start replication**
4. **Another enzyme (polymerase) adds complementary bases (nucleotides from the nuclear sap) to each single strand, forming two identical strands of DNA. The code is exactly copied because a complementary base was needed to reform the "rung of the ladder"**
5. **Another enzyme ensures accuracy of the process by "editing" any incorrect additions (mistakes would otherwise result in a change in the DNA base sequence → a mutation)**
    - **RESULT OF DNA REPLICATION → 2 IDENTICAL MOLECULES OF DNA**

Significance of DNA Replication:

- **Allows large amounts of coded information (genes and thus traits) to be passed from one generation to another, allowing continuity of a species**
- **Initiates meiosis and mitosis hence is directly responsible for growth and repair of somatic cells and creating genetically different gametes for sexual reproduction**
- **Any changes in replication process give rise to variation in a species that may be favourable in a changing environment → hence can assist in the survival of a species**
- **Without it, life would stop since it ensures the maintenance of biodiversity on Earth**