A diagram of a cell cycle

Description automatically generated

**Supplemental Figure 1. Common genetic engineering strategies used in *Drosophila*.** A- B’) The GAL4/ UAS system, isolated from *Saccharomyces cerevisiae*, has been used in *Drosophila* to express transgenes and label proteins or cells of interest using fluorescent proteins. A) GAL4 is a transcription factor that activates genes downstream of the upstream activating sequence (UAS). A’) GAL80 is temperature sensitive repressor of GAL4, which is inactive at 18 oC but binds to GAL4 and prevents its transcriptional activity at 29 oC (A’’). B-B’) shows an example of the use of the GAL4/UAS system to label cardiac cells using a cardiac cell-specific promoter, *Tin*, to drive the expression of green fluorescent protein (GFP) in cardiac cells. B) A femle carrying the GAL4 driver, whose expression is controlled by a cell specific promoter, is crossed to a male carrying a UAS<GFP transgene, which is not expressed in the absence of GAL4. This cross can also be performed reciprocally. Only cardiac cells, where Tin (a transcription factor expressed in adult cardiac cells) is expressed, will express GAL4. B’) The resulting progeny of the cross will carry both genes: tin<GAL4 and UAS<GFP. Since GAL4 will only be expressed in cardiac cells, GFP will only be expressed in cardiac cells. C-F) Another common genetic engineering technique used is the FLP/FRT recombination system, which was also isolated from *Saccharomyces cerevisiae*. Flippase (FLP) is a recombinase that facilitates DNA recombination at FLP recognition sites (FRT). This system can be used to facilitate gene transolocation, insertion, deletion, or inversion depending on the orientation and location of FRT sites. C) shows the use of FLP/FRT to generate somatic mosaics. This strategy is often used to study mutations that cause a lethality or the interaction of mutant cells with wildtype cells in a certain tissue. FLP facilitates a translocation when FRT sites are oriented in the same direction (5’-3’ for example) on two homologous chromosomes, resulting in the translocation of the mutant allele (pink) to the other chromosome (red) (C’). C’’) Once mitosis occurs, one cell will contain a non-recombinant chromosome and recombinant chromosome or two recombinant choromosomes, resulting in one cell containing two wildtype alleles, another containing two mutant alleles, and one containing a mutant allele and a wildtype allele. This strategy can be used in germline tissues to generate germline clones that give rise to mutant and wildtype progeny. D) Gene insertion into a desired site, following an FRT site in the genome, can be accomplished by flanking a gene of interest with FRT sites in the same orientation. E) Gene deletion is facilitated between two FRT sites in the same orientation of a single chromosome. F) Gene inversion can be preformed by introducing FRT sites placed in the opposite orientation of one another around the gene of interest. The FLP/FRT system can be restricted to certain tissues when combined with tissue specific promoters similar to the GAL4/UAS system.