Inversions:

Chromosomes sometimes break and then reanneal together. When a broken piece of a chromosome reanneals in the opposite order, an inversion is created. In such instances, the genes are rearranged because of this flip before the piece reanneals. It is important to note that inversions only result in a rearrangement of genes in a single chromosome. The genes come from the same chromosome as where they will end up after the inversion occurs.

There are two types of inversions: pericentric inversions, which span the centromere, and paracentric inversions, that affect only genes on one side of the centromere. In both types of inversions, the order of genes changes. This means the locus that a gene was at changes.

After an inversion, an individual still has all of the same genes. This means that their genotype remains the same. An inversion can result in no change in an individual's phenotype or could alter the phenotype of an individual. If a gene travels with its regulatory regions, its expression may remain unchanged. However, if a gene is separated from its regulatory regions or only part of a gene is moved in the process of an inversion, that gene's expression could be altered greatly.

Cells with inversions that undergo crossing over can have major changes. Typically, crossing over exchanges different alleles of the same gene between homologous chromosomes. These alleles are at the same locus on the homologous chromosomes and so they line up beside each other during recombination events. In a chromosome that has had an inversion, different genes can line up near each other and be exchanged. Crossing over of chromosomes with inversions can result in new chromosomes that have extra copies of some genes, loss of some genes, chromosomes with extra centromeres or a loss of centromere, or even larger chromosomal errors.

Knowledge check:

What are the two types of inversions? Paracentric and pericentric inversions

Explain what each looks like:

Pericentric inversions are a change in gene order that spans the centromere.

Paracentric inversions are a change in gene order, but it does not span the centromere.

Draw a picture of each type of inversion. Use colors and letters as needed.

Original Chromosome: ABCDE*FGHIJK

Pericentric inversion: ABCHGF*EDIJK

Paracentric inversion: ABCDE*KJIHGF

Practice:

Complete the following table by stating which type of inversion is described or drawn.

Image/ Description	Type of inversion
Original: ----*---- New: ----*----	Paracentric Inversion
Original: ----*---- New: ----*----	Pericentric Inversion
Original: ----*---- New: ----*-----	Pericentric Inversion
Original: ----*---- New: -------*-	Pericentric Inversion
Original: ABCDE*FGHIJK New: ABCHGF*EDIJK	Pericentric Inversion
Original: ABCDE*FGHIJK New: ABCDE*KJIHGF	Paracentric Inversion
Original: AB*CDEF New: AB* FEDC	Paracentric Inversion
Original: ABC*DEF New: ABD*CEF	Pericentric Inversion
Original: AB*CDEF New: BA*CDEF	Paracentric Inversion
A set of genes originally located at the 5' end of a chromosome ends up very near the 3' end of the chromosome.	Pericentric inversion *Note, the centromere is near the center of a chromosome. If an inversion results in a flip of genes that spans the centromere, the inversion is called a pericentric inversion.