

Source: [KBhBIO101Meiosis](#)

1 | Genetic Variation

There are two main ways by which genetic variation is introduced to a cell cycle. Namely, **crossing over** and **independent assortment**.

1.1 | Crossing over

=> The process by which genetic information between **homologous** (similar) chromosomes are exchanged.

During [KBhBIO101Meiosis](#)'s (critically, ONLY meiosis') metaphase 1, homologous chromosomes pair with each other and exchange like segments of their genetic material.

In this fashion, genetic variation is purposefully introduced into the offspring to enable more competitive variation in downstream gametes.

1.2 | Independent Assortment

During M1 and M2, which chromosomes/chromatids end up on which of the four daughter cells is up to random chance based on which side of the two spindles they are on.

Hence, this random combination of cells then create more variation in how the genetic material of the grandparents are distributed amongst the daughter cells.

1.3 | Also, Mutations

Cells could also just decide to mutate their DNAs.