

Difference Between Interchromosomal and Intrachromosomal Recombination

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Key Difference - Interchromosomal vs Intrachromosomal Recombination

DNA recombination is a process where the exchange of genetic material takes place between different chromosomes or different regions of the same chromosome. This is known as interchromosomal recombination and intrachromosomal recombination respectively. **Interchromosomal recombination could be defined as a type of genetic recombination where the sequences of nucleotides are exchanged between two identical molecules of DNA or homologous chromosomes while intrachromosomal recombination happens due to crossing over between two linked gene pairs of the same chromosome.** This is the **key difference** between interchromosomal and intrachromosomal recombination.

What is Interchromosomal Recombination?

Interchromosomal recombination results from the independent assortment. Independent assortment is a process where different genes independently separate from each other during the development of reproductive cells. Interchromosomal recombination is also referred to as **homologous recombination**. In other terms, interchromosomal recombination could be defined as a type of genetic recombination where the sequences of nucleotides are exchanged between two identical molecules of DNA or homologous chromosomes. Interchromosomal recombination actively involves in the accurate repair of double-strand breaks (DSBs). DSBs are harmful breaks that take place on both strands of a DNA molecule.

Interchromosomal recombination is an important process that takes place within the mammalian system where it produces different new combinations of DNA sequences. This development of new sequences takes place during meiosis where the eukaryotic organisms make gamete cells which include sperms and egg cells. Interchromosomal recombination that leads to an independent assortment of genetic material develops genetic variations in offspring due to new DNA combinations. Induction of these variations through interchromosomal recombination provides adequate resistance to the organisms to adapt and survive in a particular niche and also plays a major role in the context of evolution. Not only for independent assortment, but interchromosomal recombination could also be utilized for horizontal gene transfer where the exchange of genetic material takes place between different

species and strains of organisms that include bacteria and viruses. Interchromosomal recombination suggests universal biological mechanism since it is considered as conserved across the main three domains of life forms including viruses.

What is Intrachromosomal Recombination?

Intrachromosomal recombination is also known as non-homologous recombination that plays an important role in the mammalian biological systems. It is resulted due to crossing over between two linked gene pairs of two non-homologous chromosomes. Intrachromosomal recombination leads to different medical conditions within the mammalian body. It was found out that the development of many metastatic tumours is due to the accumulation of different patterns of intrachromosomal recombination. Intrachromosomal recombination is most prevalent during transfection of DNA into mammalian cells. This intrachromosomal or non-homologous recombination takes place at random genomic sites. But even though much research has been conducted on this aspect, scientists have failed to fully understand the mechanism of intrachromosomal recombination that takes place at random genomic sites.

Rearrangement of DNA sequences such as T cell receptor rearrangement, immunoglobulin receptor rearrangement, retroviral integration, transposition, and retrotransposition is facilitated and accomplished by intrachromosomal recombination. During some of these recombination phenomena, the involvement of transient double-strand break (DSB) takes place.

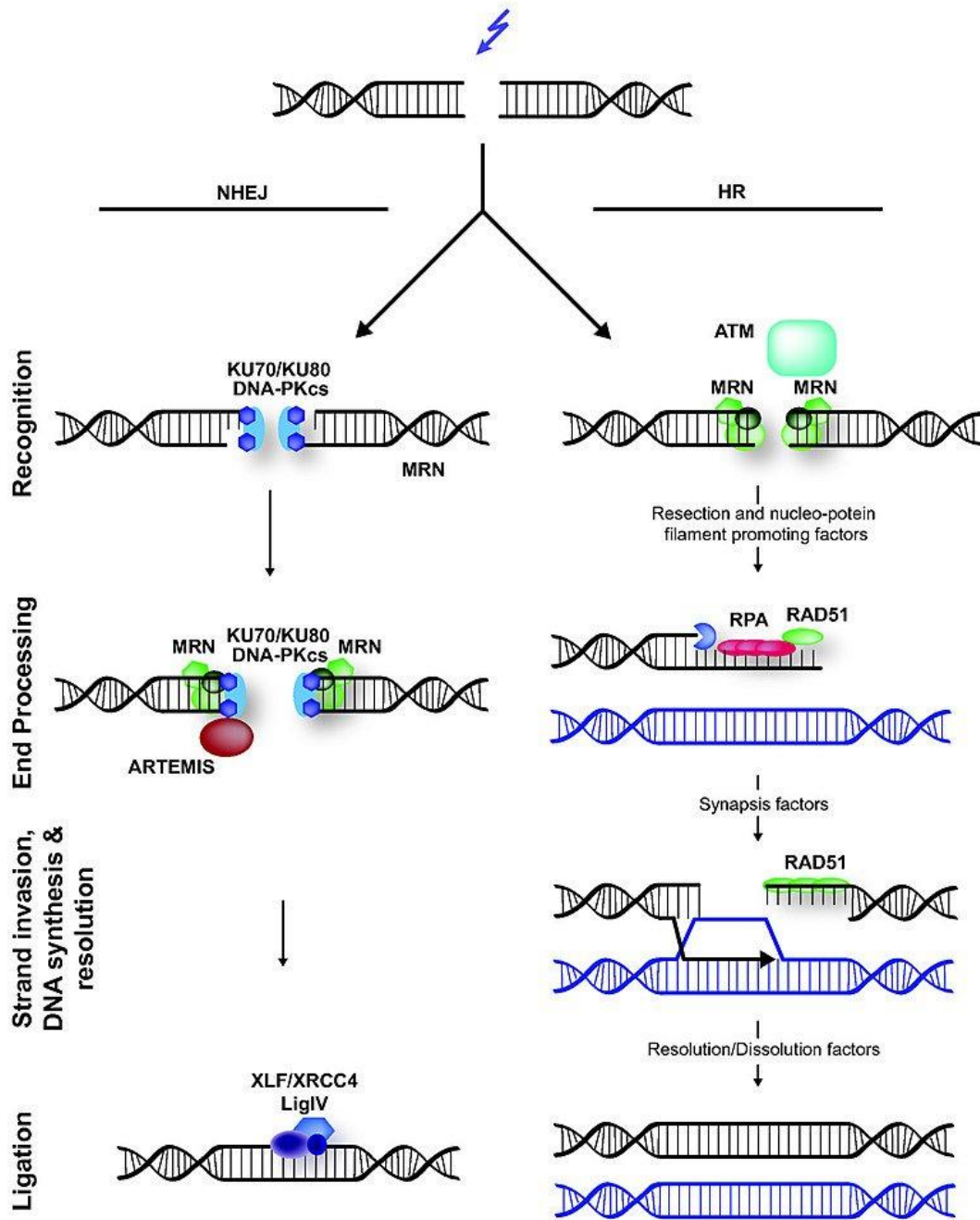


Figure 01: Mammalian double-strand break (DSB) repair by Intrachromosomal Recombination

Similar to interchromosomal recombination, intrachromosomal recombination also actively involves in the accurate repair of DSBs. Intrachromosomal recombination process has a special mechanism to rectify the DSBs since DSBs has the potential to become lethal if they are not repaired with suitable mechanisms. Breakage fusion bridge cycle (BFBC) is an important pathway of repair that is induced by intrachromosomal recombination process to repair somatic chromosomal DSBs. Therefore, intrachromosomal recombination is considered as an important aspect in the context of many biological phenomena that takes place within the mammalian systems.

What is the Similarity Between Interchromosomal and Intrachromosomal Recombination?

- Both involve in the accurate repair of DSBs of DNA.

What is the Difference Between Interchromosomal and Intrachromosomal Recombination?

Interchromosomal vs Intrachromosomal Recombination	
Interchromosomal recombination is a type of genetic recombination where the sequences of nucleotides are exchanged between two identical molecules of DNA.	Intrachromosomal recombination is resulted due to crossing over between two linked gene pairs of two non-homologous chromosomes.
Occurrence	
Interchromosomal recombination occurs between genes of different chromosomes.	Intrachromosomal recombination occurs between genes of the same chromosome.
Synonyms	
Homologous recombination is a synonym for interchromosomal recombination.	Non-homologous recombination is a synonym for intrachromosomal recombination.

Summary - Interchromosomal vs Intrachromosomal Recombination

DNA recombination is a process where the exchange of genetic material takes place between different multiple chromosomes or different regions of the same chromosome. Interchromosomal recombination is a type of genetic recombination where the sequences of nucleotides are exchanged between two identical molecules of DNA of identical or homologous chromosomes. It results from the independent assortment. It could be utilized for horizontal gene transfer where the exchange of genetic material takes place between different species and strains of organisms. Intrachromosomal recombination is also known as non-homologous recombination. It is resulted due to crossing over between two linked gene pairs of two non-homologous chromosomes. Both inter and intrachromosomal recombination actively involves the accurate repair of DSBs.

Reference:

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