REPORT ON CHROMOSOMES AND SEX-CHROMOSOME INHERITANCE

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ABSTRACT

Inheritance refers to the mechanism of transmission of traits from parents to offspring. It can occur particularly through two mechanisms – genetic mechanism and epigenetic mechanism. Genetic mechanism of inheritance involves the process of gene transmission through DNA replication while epigenetic inheritance occurs through the secondary modification of genome or chromatin. The chromatic modification can include DNA methylation or histone modifications mechanism. DNA methylation involves the addition of methyl group to the **5'-**carbon of cytosine ring while Histone modification inheritance happens based on the propagation of histone modification patterns. In this report we will focus on gene linkage on chromosome, meiosis cell division process as a basis inheritance, and various human disorders caused due to alteration of chromosomal structures.

GENE LINKAGE ON CHROMOSOME

Gene Linkage refers to the close co-location between two or more that two genes. Often, there are chances that the co-located located genes are transferred from parents to offspring together. The transmission of these genes from parent to child is often known as genetic linkage. These genetic linkages can be identified using genetic tools within families together. Gene, which is more closer to another gene, have better chances of identification than the gene which is farther away while identifying the genetic linkage.

There could be unlinked and linked genes within the same chromosome or different chromosome. Those genes, which are found in different chromosomes or are far apart within the same chromosome assort independently are known as unlinked genes. Linked genes are close together to each other. These linked genes or alleles have higher frequency of getting transmitted as a single unit. Gene linkage and their binding affinity can be calculated using recombination frequency obtained from genetic crosses.

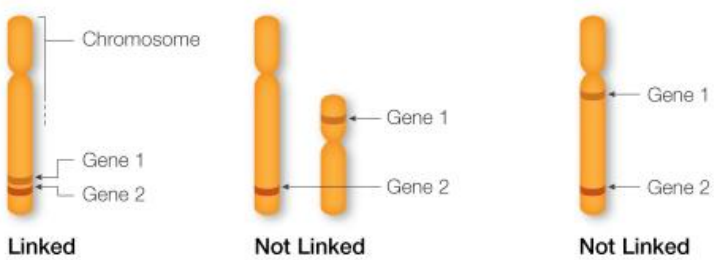

Fig 1. Linked and Unlinked Gene

LINK BETWEEN GENETIC INHERITANCE AND MEIOSIS

We all bear certain kind of similarity among our family members such as eye size, nose tip, or height which may look similar to your father, mother or grandparents; however, we bring many dissimilarities too. This passing of genetic information from parents to offspring happens in simple organisms (unicellular) by replication of genetic material and splitting to form new organism. In multicellular (complex organisms), it occurs withing specialized cells called Sex Cells (Gamete) that splits into half and carries only half of the genetic information. This process of gamete formation is known as Meiosis. The gamete cells or sex cells in male are known as sperms while female gamete cells are known as egg or ova. When the crossing happens between male and females, the haploid cell, one from each parent combines to form a new organism.

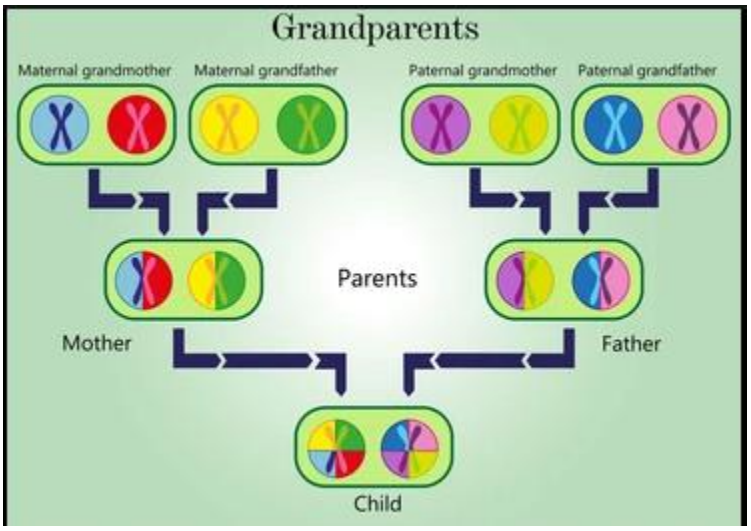

Fig 2. Genetic Inheritance

During the meiosis process, the homologous chromosomes (one from each parent) crosses over. It involves the recombination mechanism where two chromosomes break down, rejoins and exchange genetic material at point known as chiasma. This recombination induces the genetic variation in organism.

CHROMOSOMAL ABNORMALITIES AND HUMAN DISORDERS

Chromosomal abnormality or disorder is an irregular change in the segment of DNA which may arise due to addition, removal or replacement of genetic material. Fundamentally, these can be categorized into two groups: Structural abnormalities, Numerical abnormalities.

Normal human being contains 23 pairs of chromosomes. Numerical abnormality occurs when an organism is having more-or-less number chromosomes than their parents contain. This condition is known as aneuploidy. Chromosomes resides in a pair. Monosomy is the condition where there is one missing chromosome from chromosome pair, while trisomy condition possesses more than two chromosomes. Trisomy-21 is a special abnormality found in the 21st chromosome of human cell. This abnormality is also known as Down Syndrome, in which human feels mental retardation, learning difficulty, poor muscle tone etc. A Monosomy condition, where female is born with only one sex chromosome (X) is not able to give birth is also known as Turner syndrome.

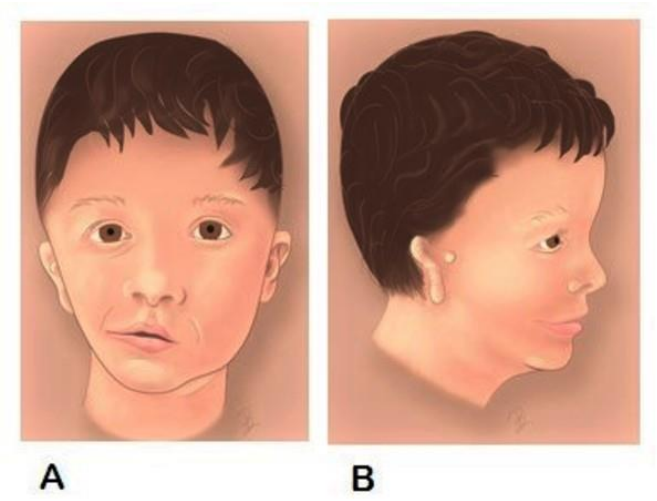

Fig 3. Numerical abnormality - Trisomy-21

Structural abnormalities can occur in chromosomes due to various reasons such as deletion, duplication, translocation, inversion of the chromosome segment. If a portion of chromosomal segment is missing from a specific chromosome, it is considered as deletion abnormality. Duplication abnormality occurs when a genetic material is duplicated in a chromosome, when a portion of chromosome is transferred from one chromosome to another chromosome, it is referred to as translocation abnormality. If a genetic material is inverted in chromosome due to breakage in chromosomal structure, we call it inversion abnormality.

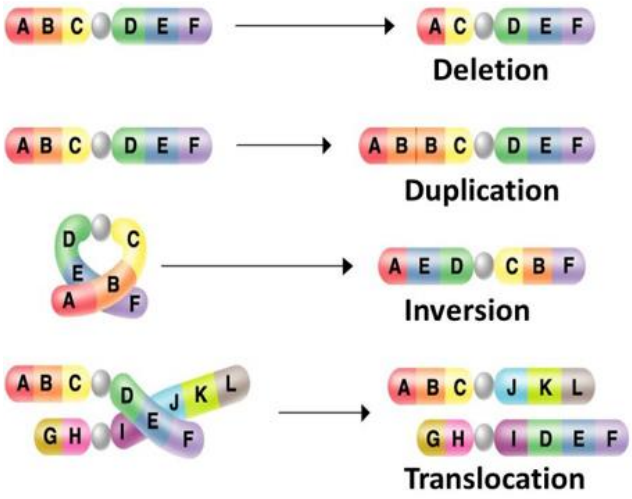

Fig 4. Structural abnormalities in DNA

CONCLUSION

In this report, we summarized how genetic linkage and meiosis cell division plays a role in transferring genetic information from parents to offspring and various human disorders caused to due to change in chromosomal structures in human.

REFERENCES

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