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A Brief Note on Cytogenetics

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Description

Cytogenetics is essentially a branch of genetics, but it is also part of cell biology/cytology which is a branch of human anatomy that deals with how chromosomes relate to cell behavior, especially during mitosis and related meiosis with behavior. Techniques used include karyotype analysis, chromosome band analysis, other cytogenetic banding techniques, and molecular cytogenetics such as Fluorescence *in Situ* Hybridization (FISH) and Comparative Genomic Hybridization (CGH). Fluorescent probes used in Fluorescent *in Situ* Hybridization (FISH) only bind to those parts of a nucleic acid sequence with a high degree of sequence complementarity. It is used to detect and locate the presence or absence of specific DNA sequences on chromosomes. The fluorescence microscope can be used to find out the binding position of the fluorescent probe and the chromosome. FISH is generally used to find specific characteristics in DNA for genetic counseling, medicine, and species identification. It can also be used to detect and localize specific RNA targets (mRNA, lnc RNA, and miRNA) in cells, circulating tumor cells, and tissue samples. It can help define the spatiotemporal patterns of gene expression in cells and tissues. Comparative Genomic Hybridization (CGH) can be used to routinely extract DNA from fixed tissues to assess the DNA copy number changes in the entire genome. CGH analysis shows that the difference between melanoma and melanocytic nevus is that there are frequent chromosomal aberrations.

Cytogenetics involves analyzing tissue, blood, or bone marrow samples in the laboratory to look for changes in chromosomes, including breaks, deletions, rearrangements, or additional chromosomes. Certain chromosome changes can be signs of genetic diseases or conditions or of certain types of cancer. Cytogenetics includes clinical cytogenetics and molecular cytogenetics. Clinical cytogenetics is the study of the relationship between human chromosomal changes and genetic diseases and molecular cytogenetics is the use of new technologies that combine cytogenetics and molecular technology to study heredity.

Cytogenetics involves examining chromosomes to identify structural abnormalities. Chromosomes in human cells can be clearly analyzed in white blood cells, especially T lymphocytes, which are easily removed from the blood. Under a microscope, the chromosomes are counted and checked for quantitative or structural abnormalities. Molecular cytogenetics which combines the two disciplines of molecular biology and cytogenetics involves the analysis of the structure of chromosomes to help distinguish between normal cells and cancer cells. Although flow cytometry is rapid and reliable, a complete cytogenetic evaluation reveals prognostic information about possible future disease progression, which cannot be obtained with flow cytometry alone. Therefore, these technologies are usually used in combination to make a complete diagnosis and prognosis of the disease.

Cytogenetics technology is cancer treatment to detect genetic changes in tumor cells. This is particularly related to hematological malignancies, but more and more solid tumors play a role in them. Chromosomal abnormalities are the basis for the development of various diseases and disorders from down syndrome to cancer, and have a wide range of interests in basic and clinical research. A cytogenetic map is the visual appearance of chromosomes when they are stained and examined under a microscope. Of particular importance are the visually distinct areas, called bright and dark bands, which give each chromosome a unique appearance. Cytogenetic evaluation of pregnancy products is suitable for suspected chromosomal causes of multiple birth loss or fetal loss/abnormality. Ideal samples include chorionic villi and fetal tissue.