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Molecular Basis of Cancer

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In the normal circumstances , the proliferation of body cells is under strict control. The cells differentiate , divide and die in a sequential manner in a healthy organism. **Cancer is characterized by loss of control of cellular growth and development leading excessive proliferation and spread of cells .**
Cancer arising from epithelial cells are referred to as carcinomas while that from connective tissue are known as sarcomas.
Cancer is the second largest killer disease the first being coronary heart disease.

Etiology
In general cancers are multifocal in origin. The causative agents include physical, chemical, genetic and environmental factors .

Chemical carcinogens:
It is estimated that almost 80% of the human cancers are caused by chemical carcinogens in nature. The chemicals may be organic example dimethylbenzahthracene , benzo pyrene , dimethylnitrosamine or inorganic arsenic, cadmium in nature.
The carcinogens can covalently bind to purines , pyrimidines and phosphodiester bonds of DNA , often causing unrepairable damage . The chemical carcinogens frequently cause mutation finally lead to cancer.

Radiation energy :
Ultraviolet rays, x-rays, and gamma rays have been proved to be mutagenic in nature causing cancers . These rays damage DNA which is the basic mechanism to explain the carcinogenicity of radiation energy.

Carcinogenic viruses
The present of viral particles and the enzyme reverse transcriptase , besides the occurrence of base in the DNA of malignant cells , complementary to tumour the viruses indicate involvement of viruses in cancer.
CLASS
DNA VIRUS
HERPES VIRUS
PAPO VIRUS
RNA VIRUS
RETROVIRUS TYPE B, RETROVIRUS TYPE C

DNA – ULTIMATE IN CARCINOGENESIS
DNA is the ultimate critical macromolecules in carcinogenesis .
1 cancers are transmitted from mother to daughter cells .
2 chromosomal abnormalities are observed in mant tumour cells.
3 damage to dna caused by mutations often results in carcinogenesis.

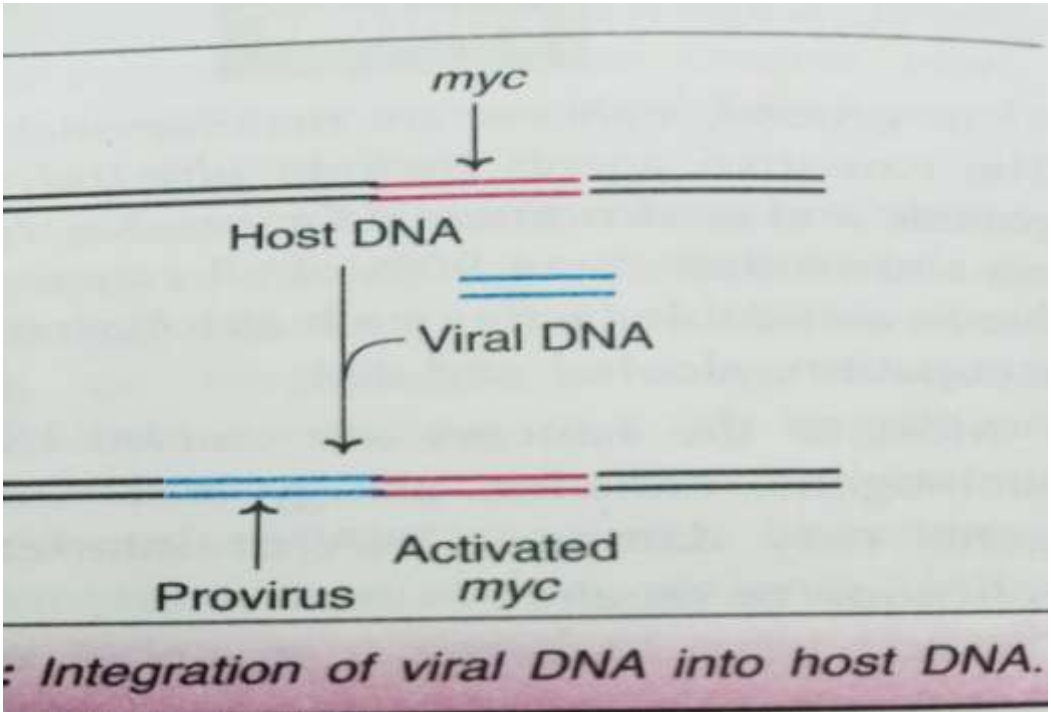
Molecular basis of cancer
Cancer is caused by a genetic change in a cell resulting in its uncontrolled multiplication . Thus tumours are monoclonal . two types of regulatory genes – oncogenes and antioncogenes are involved in the development of cancer (carcinogenesis)

oncogenes
The genes capable of causing cancer are known as oncogenes . oncogenes were originally discovered in tumour causing viruses. These viral oncogenes were found to be closely similar to certain genes present in the normal host cells , which are referred to as protooncogenes . Protooncogenes encode is growth – regulating proteins . The activation of protooncogenes to oncogenes is an step in causation

of cancer.

Activation of protooncogenes to oncogenes

Viral insertion into chromosome when certain retroviruses genetic material RNA infect cells , a complementary DNA is made from their RNA by the enzyme reverse transcriptase .



Integration of viral DNA into host DNA.

Mechanism of action of oncogenes

Oncogenes encode for certain proteins, namely oncoproteins , . These proteins are the altered versions of their normal counterparts and are involved in the transformation and multiplication of cells . some of the products are discussed below.

Growth factors: several growth factors are stimulating the proliferation of normal cells are known. They regular cell division by transmitting the message across the plasma membrane to the inferior of the cell transmembrane signal transduction,

A list of growth factors the sources are given rise to

Epidermal growth factor:

Source salivary gland , firoblasts, fuction as stimulates growth of epidermal and and epithelial cells.

Platelet derived growth factor

Derived from platelets function as stimulating growth of mesenchymal cells promotes wound healing.

Transforming growth factor alpha:

Source from epithelial cells stimulates growth of epidermal and epithelial cells,

Transforming growth factor beta:

Platelets ; inhibitory (sometimes stimulatory) effect on cultured tumour cells.

Erythropoietin:

Derived from kidney, stimulates development of erythropoetic cells.

Nerve growth factor :

Salivary gland ; stimulates the growth of sensory and sympathetic meurons.

Insulin like growth factors (IGF-I, IGF-II RESPECTIVELY KNOWN AS SOMATOMEDINS C AND A): Serum,

Tumour necrosis factor alpha :

Monocytes; necrosis of tumour cells .

Interleukin -1

Monocytes , stimulates synthesis of IL-2 ; STIMULATES GROWTH FACTOR, AND MATURATION OF T-CELLS.

The cell proliferation is stmulated by growth factors , in general , a growth factor . In general , a growth factor binds to a protein receptor on the plasma membrane , this binding activates cytoplasmic protein kinase leading to the phosphorylation of intracellular target proteins ; which stimulate cells division .

Anti-oncogenes :
A special category of genes, namely cancer suppressor genes or more commonly antiongenes.

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