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Topic: Cancer

Cancer

- Cancer is a non-infectious disease. It starts at the molecular level of the cell and, ultimately affects the cellular behaviour. Generally, it can be defined as uncontrolled proliferation of cells without any differentiation.
- Hence, when a cell of a specific tissue divides, it normally produces its own kinds of cell of the tissue to which it belongs. It never produces the cells of other tissues.
- Therefore, the process by which cells achieve this specification and specialisation is known as cellular differentiation. Differentiation of cell begins during embryonic gastrulation stage and continues through tissue formation.
- Actually differentiation has a genetic basis and the process results from the interaction of the nucleus and the cytoplasm. After the cells become well-differentiated, they cannot go back normally to the undifferentiated stage unless disturbed internally or externally.
- Therefore, in multicellular organism, the cell division, differentiation and survival of individual cells are carefully regulated to meet the needs of the

organism as a whole. When this regulation is lost due to any reason, the cells behave unusually and defy their control mechanism.

- Then the cells grow and divide in an uncontrolled manner ultimately spreading throughout the body and interfering with the functions of normal tissues and organs.
- As a whole, this condition leads to cancer. Cancer develops from defects in fundamental regulatory mechanisms of the cell.

Types of cancer:-

(i) Carcinomas:

- It includes approximately 90% of human cancer. This type is principally derived from epithelial cells of ectoderm and endoderm.
- The solid tumours in nerve tissue and in tissues of body surfaces or their attached glands are example of carcinomas. **Cervical, breast, skin and brain** carcinomas are developed from malignant tumour.

(ii) Sarcomas:

- Sarcomas are solid tumours of connective tissues such as **muscle, bone, cartilage and fibrous tissue**. These types of malignant tumours are rare in human (about 2% of human cancer).

(iii) Lymphomas:

- It is a type of malignancy in which there is excessive production of lymphocytes by **the lymph nodes and spleen**.

- It accounts for approximately 8% of human cancers. Hodgkin's disease is an example of human lymphoma.

(iv) Leukemia's:

- This type of malignancy arises from the blood forming cell. **Leukemia's are commonly known as blood cancer.** Leukemia's are neoplastic growth (uncontrolled cell growth at the cost of remaining cells) of leucocytes or WBC.
- They are characterised by excessive production of WBC of the blood. The name leukemia is derived from Greek leukos (white) + haima (blood) the massive proliferation of leukemia cells can cause a patient's blood to appear milky.
- In addition to the types of cancer mentioned above, cancers are further classified according to tissue of origin, for example lung cancer, breast cancer, and the type of cells involved.
- For example fibro sarcoma arises from fibroblasts, erythromoid leukemia's from precursor of erythrocytes. Although there are many kinds of cancer, the four most common cancers are those of prostate, breast, lung and colon/rectum.

How Do They Start?

- Cancer cells appear through a series of genetic and epigenetic changes. Some of these changes may be either inherited or more often, caused by carcinogens in our environment.

- Multiple mutations. Interestingly, the metastatic process that is the main culprit for the high mortality of advanced cancers is thought to be caused mostly by epigenetic changes as no specific genetic alterations have been found in metastases.
- It also helps explain a genetic predisposition to cancer. A genetic predisposition does not mean they will get cancer, but, simplistically, if a few mutations are already in place, it will likely take fewer acquired mutations for a cell to become cancerous.
- The process of normal cells becoming cancer often goes through stages in which the cell becomes progressively more abnormal appearing. These stages may include hyperplasia, dysplasia, and finally cancer.
- Early on a cell may look much like normal cells of that organ or tissue, but as progression occurs, the cell becomes increasingly undifferentiated. This is, in fact, why sometimes the original source of cancer cannot be determined.

Cancer Cells vs. Normal Cells:

There are many important differences between cancer cells and normal cells. Some of these include:

- **Growth:** Normal cells grow as a part of growth and development such as during childhood or to repair injured tissue.

Cancer cells continue to grow (reproduce) even when further cells are not needed. Cancer cells also fail to listen to signals that tell them to stop growing or

commit cell suicide when the cells become old or damaged.

- **Ability to invade nearby tissues:** Normal cells respond to signals from other cells which tell them they have reached a boundary. Cancer cells do not respond to these signals and extend into nearby tissues often with finger-like projections. This is one reason why it is difficult at times to surgically remove a cancerous tumor.
- **Ability to spread (metastasize) to other regions of the body:** Normal cells make substances called adhesion molecules that cause them to stick to nearby cells.

Cancer cells, lacking the stickiness caused by these adhesion molecules, can break free and float to other regions of the body.

They may travel to nearby tissue or through the bloodstream and lymphatic system to areas of the body far from the original cancer cell—for example, a lung cancer cell may travel to the lymph nodes, brain, liver, or the bones.

- **Immortality:** Normal cells, like humans, have a lifespan. When they reach a certain age, they die. Cancer cells, in contrast, have developed a way to “defy” death.

On the end of our chromosomes is a structure known as a **telomere**. Every time a cell divides, its telomeres become shorter. When the telomeres become short enough, the cells die.

Cancer cells have figured out a way to restore their telomeres so that they don't continue to shorten as the cell divides, thus, in a way, making them immortal.

The ability to invade and metastasize is very important in differentiating a cancer cell from a normal healthy cell, but there are many other important distinctions as well.

Cancer Cell

- May keep growing
- May invade nearby tissues
- May spread to other regions of the body
- Can be immortal

Normal Cell

- Grows when needed
- Stays within tissue boundaries
- Sticks to nearby cells
- Has defined lifespan