Tumor (Neoplasia)

◆ Uncontrolled cell division.

◆ Abnormal mass of tissue growth which exceed and in-coordination with that of the normal tissue and persists even when the stimulus is removed.

Types of tumors

◆ Benign tumor (good)
◆ Malignant tumor (bad)

Components of tumor

◆ Parenchymal tissue which represents the functional cells (i.e. made up of transformed or neoplastic cells.

◆ The supporting tissue or stroma which represent the connective tissue and blood vessels.

Tumor Nomenclature

Normal Tissue	Benign Tumors	Malignant Tumors
Glandular epithelium	Adenoma	Adenocarcinoma
Surface/ squamous epithelium	Papilloma	Squamous carcinoma
Fibroblasts	Fibroma	Fibrosarcoma
Cartilage	Chondroma	Chondrosarcoma
Striated muscle	Rhabdomyoma	Rhabdomyosarcoma
Smooth muscle	Leiomyoma	Leiomyosarcoma
Blood vessels	Haemangioma	-
Endothelium	-	Angiosarcoma
Fat	Lipoma	Liposarcoma
Bone	Osteoma	Osteosarcoma
Liver	Hepatoma	Hepatocellular carcinoma

Characteristics of Benign And malignant tumors

1. Mode of growth

Benign	Malignant
1. Grows by expansion and doesn't infiltrate the surrounding tissue. 2. Usually encapsulated	1. Expansion, infiltration. 2. Uncapsulated.

2. Rate of growth

Benign	Malignant
Slow and may stop	Rapid

3. Cell characteristic

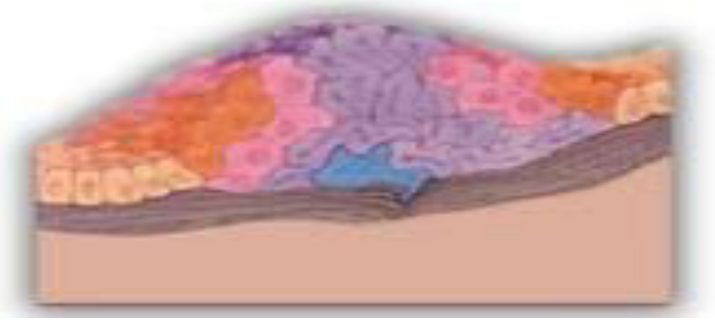
Benign	Malignant
Well differentiated i.e. Cells of tumor resemble normal cells of tissue.	Cells are undifferentiated i.e. tumor cells resemble fetal cell.

4. Metastasis

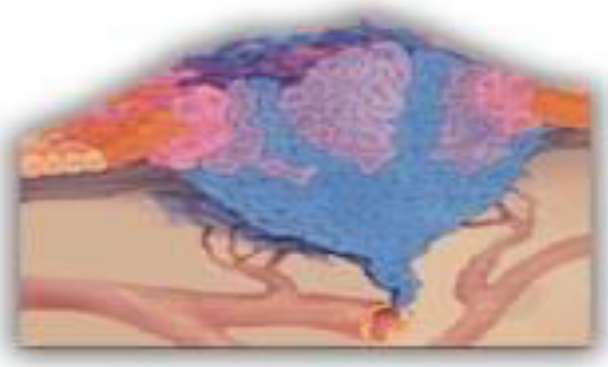
Benign	Malignant
Does not spread by metastasis	Spread by blood, lymph channels and body cavities

In-Situ Cancer...

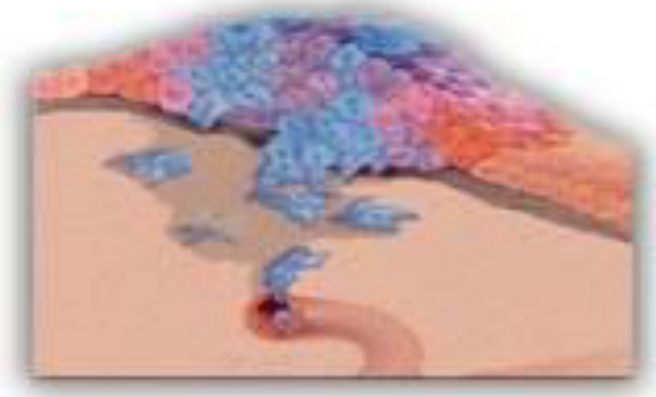
As this mass of abnormal cells grows, it increases in size (when cell growth exceeds cell death). As long as the tumor doesn't break through any surrounding tissues, it is known as an "in-situ cancer." The tumor can .remain in this state indefinitely



The tumor cells invade the surrounding tissue and reach the blood vessel



The neoplastic cells invade the blood vessel

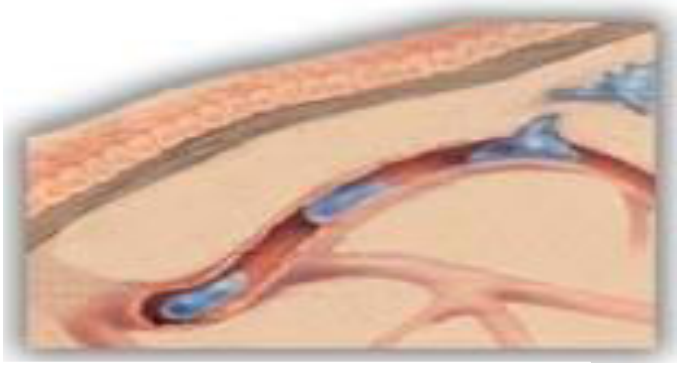


Traveling Through Blood Vessels...

The blood vessels are freeways for these mutant cells to use to colonize other parts of the body. Unfortunately, these destinations include the .heart, lungs, pancreas, and all other organs and tissue

Secondary Tumor Sites...

The cells adhere to the inside of the vessel walls, allowing them to stop and .then break through the blood vessels to plant new tumor colonies



5. Tissue destruction

Benign	Malignant
Mild tissue damage	Causes extensive tissue damage

6. General effects

Benign	Malignant
Doesn't cause generalized effects except when location interferes with vital function.	Often causes generalized effects such as anemia, weakness and weight loss.

7. Ability to cause death

Benign	Malignant
Doesn't cause death unless by its location, it interferes with vital organs function.	Cause death

Ischemia and tissue necrosis

◆ Because of rapid rate of growth of malignant tumors tends to compress on blood vessels and outgrow their blood supply.

Anaplasia

◆ This term used to describe the lack of cell differentiation in cancer cells.

Changes associated with cancer cells

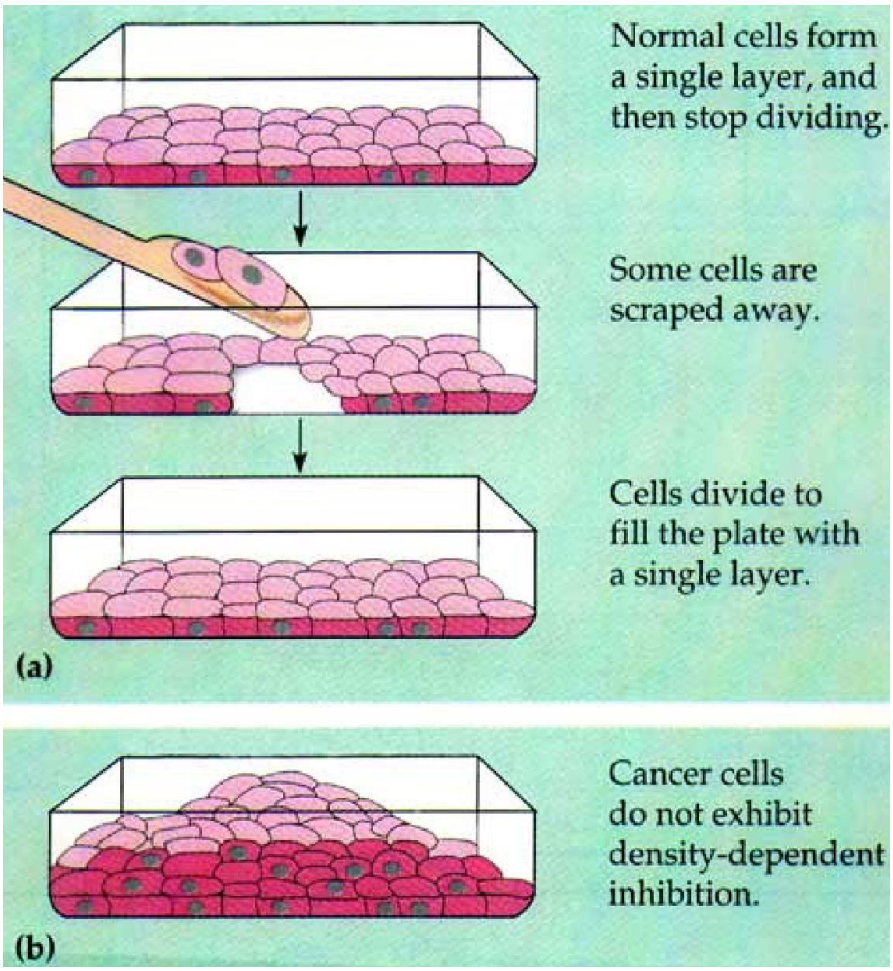
◆ Loss of contact inhibition.

◆ Loss of adhesion between cells so that the cells do not stick together this leads to permit shedding and spread.

◆ The cancer cells are resistant to conditions or substances which normally kill the normal cells e.g. anoxia, ammonia and others.

◆ Expression of altered tissue antigen.

Density-Dependent inhibition of cell division



◆ Most cancer cells elaborate enzymes that break down proteins and lead to spread of tumor cells.

Oncogenesis

❋ Means the genetic mechanism whereby normal cells are transformed into cancer cells.

❋ Abnormality in 4 kinds of genes may leads to uncontrolled cell division.

❋ These kinds of genes are:

1. Proto-oncogenes. the growth promoting
2. Suppressor genes. the growth-inhibiting tumor
3. Genes that regulate programmed cell death (apoptosis
4. Genes involved in DNA repair.

Theories of Oncogenesis

Deletion hypothesis theory

❋ This theory talk about deletion of some regulatory proteins which present in cell and these proteins are responsible for prevent the cell from going to uncontrolled cell division

Chromosomal or DNA alteration theory

❋ It is well known because it deals with alteration of DNA using chemical or physical treatment like radiation which cause breaks chromosomes so neoplastic will be seen.

❋ Alteration in RNA.

Loss of control theory

❋ This theory talk about loss or change in type of histon in the nucleus.

❋ Histones inhibit DNA and mRNA synthesis so if histons are removed from nucleus this will lead to increase in DNA synthesis and mRNA synthesis.

Mechanism of neoplasia

Normal cell can transform to cancerous cell by carcinogenic agent by two stages:

1. Initiation: Caused by true carcinogen (initiator) which act by some way to produce irreversible changes in the DNA of the target cells. So initiators prepared cells for transformation to cancer cells.

2. Promotion: Caused by promoters. These promoters turn on neoplasia process in initiated cells.

Promoters have little or no ability to cause cancer in absence of initiator

Promoters act by

1. Alteration gene expression.
2. Increasing DNA synthesis.
3. Enhancing amplification (increasing the number of gene copies)

Causes of tumor

1. Heredity:

- Some tumors known as inherit tumor.

Like breast cancer occurs more frequently in women whose grandmother, mothers, aunts, and sisters also have experienced a breast malignancy.

- Several cancers exhibit an autosomal inheritance pattern like:

Xeroderma pigmentosum

2. Chemical carcinogens

- Tar, oil, asbestosis, Azo dyes, insecticides, fungicide, CCl4, hormones.

- Chemical carcinogens act by:

a. Cause mutation

b. Alteration in synthesis of cell enzymes and structural proteins

3. Radiation

4. Viruses

- RNA viruses (Retroviruses)
- Human T cell leukemia virus type I (HTLYI) caused T cell leukemia/ lymphoma.
- Transmitted by: sexual, infection blood, infected milk breast.
- Herpes virus (human Papilloma Virus)
- Epstein- Bar virus (Burkett's and nasopharyngeal cancer).
- Hepatitis B virus

5. Immunological defect

- People with immunodeficiency diseases.
- People with organ transplantation.
- Elderly people
- Kaposi's sarcoma with AIDS

Diagnostic Methods

- ✓ Cytopathological study: e.g. Pap smear
- ✓ Histological Study
- ✓ Tumor Markers: Substances released by tumor cells or released by normal cell in response to tumor

e.g. Prostate Specific Antigen (PSA), Human Chronic Gonadotropin (HCG)

Grading And Staging Of Tumors

- Grading: I, II, III, IV, is depending on the cellular characteristic of tumor:

Mitotic figures

Level of cell differentiation.

- Staging of Tumors: the American Joint Committee on Cancer Staging (7th Edition on 2010; 8th Edition on 2017)

  T: primary tumor
  N: lymph node involvement
  M: metastasis