

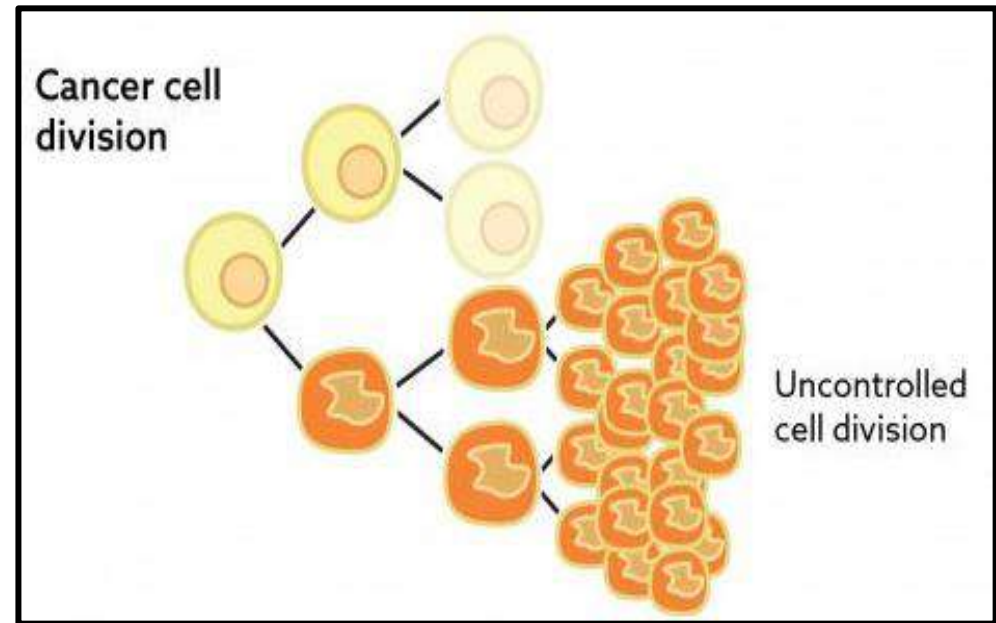
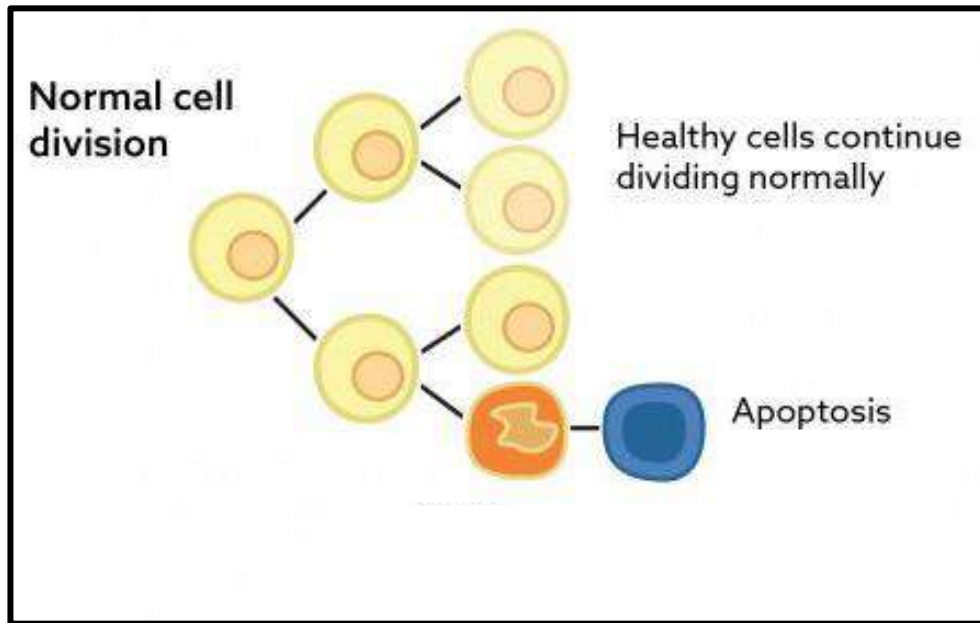
Pathophysiology II

Chapter (6): Cancer

- Cell cycle
- Cancer terminology
- Benign and malignant tumors
- Characteristics of malignant tumors
- Detection of malignant tumors
- Selected types of malignant tumors

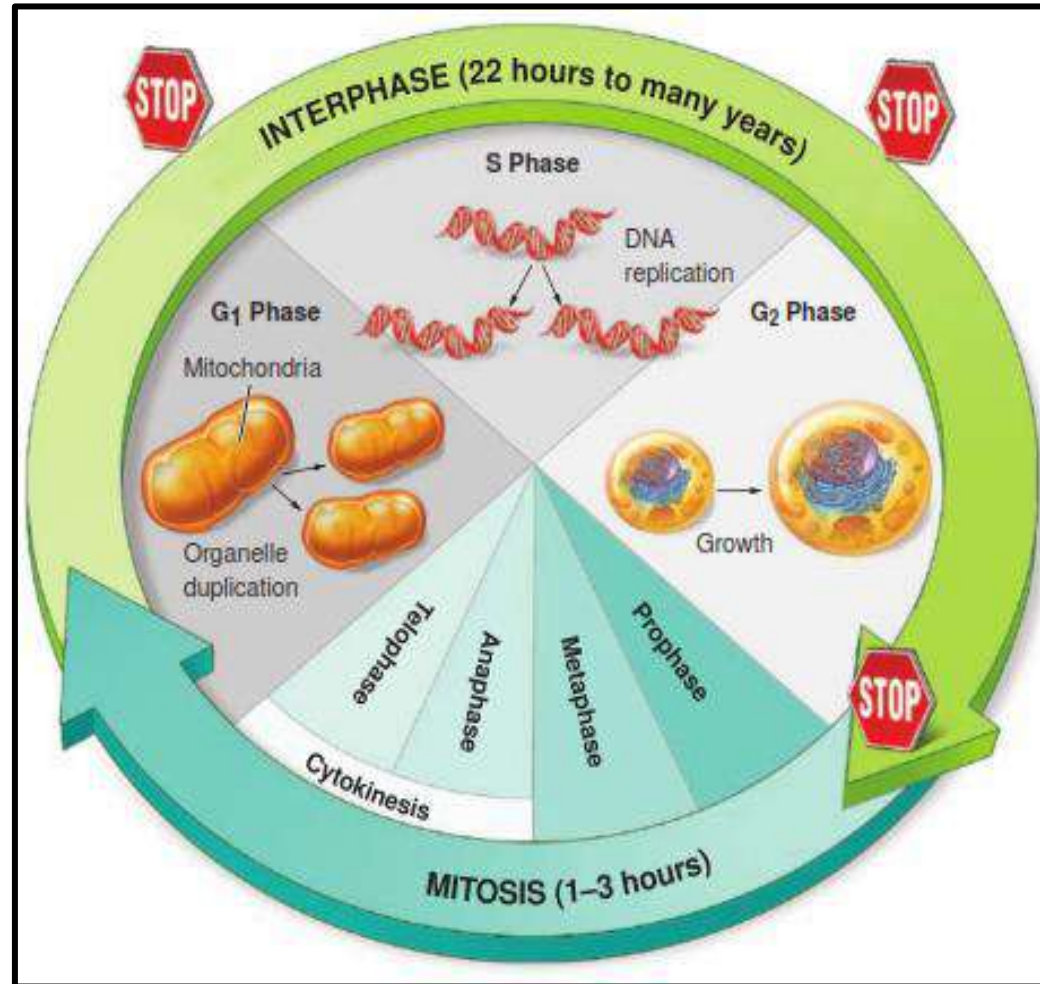
Cancer

- Cancer is a group of diseases characterized by abnormal and uncontrolled cell growth with the potential to invade or spread to other parts of the body.



Cancer

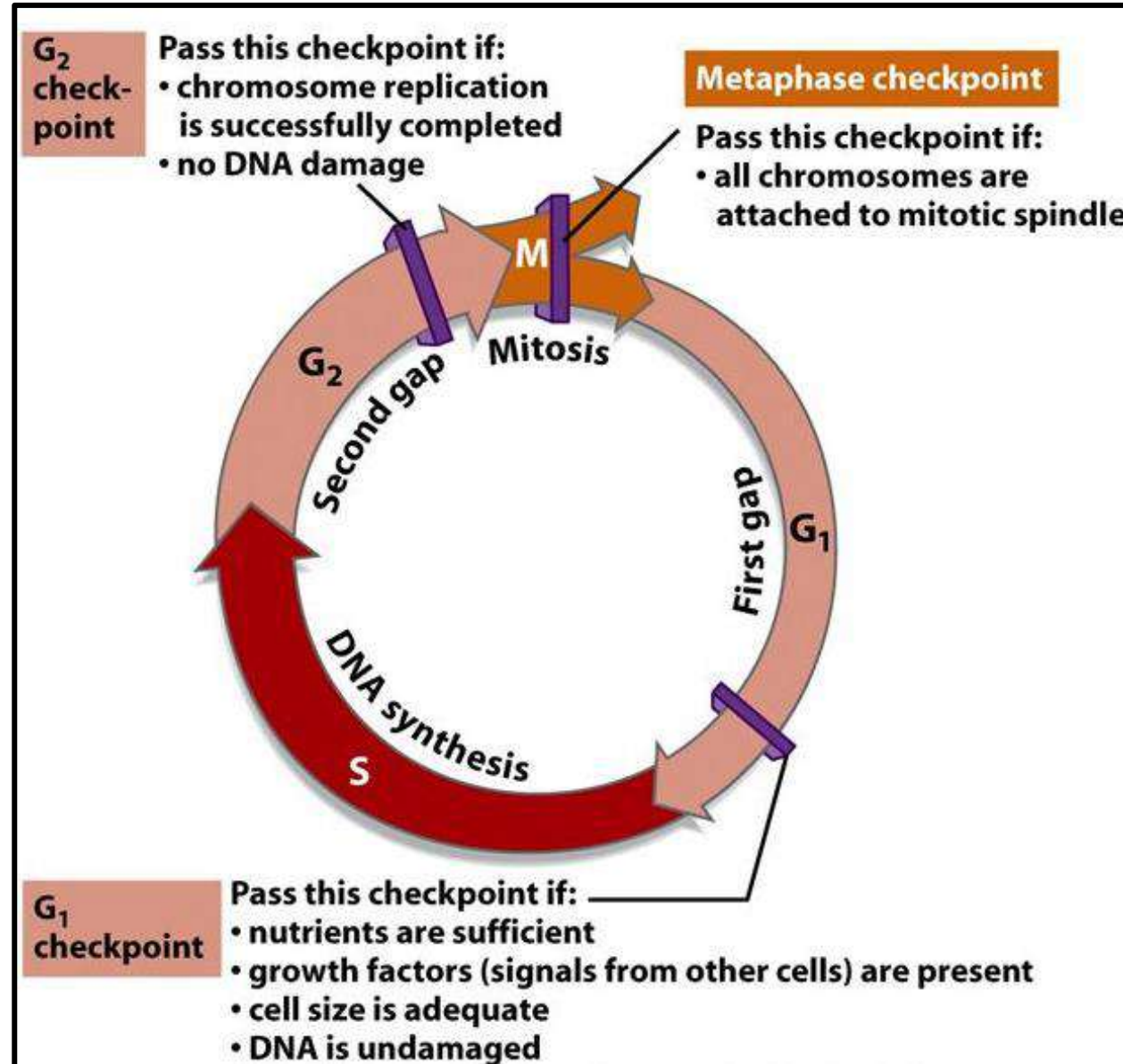
- Cell cycle



Cancer

Regulation of cell cycle

- Growth factors
- Cell cycle checkpoints



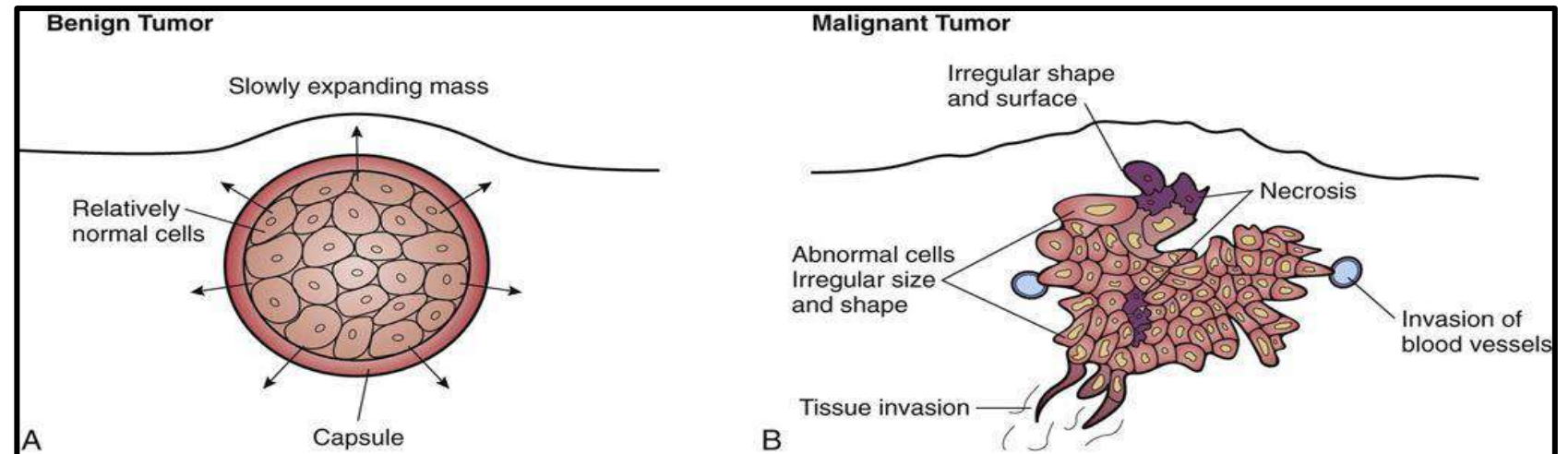
Cancer

Terminology

- Cancer
- Oncology
- Neoplasm
 - Benign
 - Malignant

- Neoplasia

CHARACTERISTICS	BENIGN	MALIGNANT
Cell characteristics	Well-differentiated cells that resemble cells in the tissue of origin	Cells are undifferentiated, with anaplasia and atypical structure that often bears little resemblance to cells in the tissue of origin.
Rate of growth	Usually progressive and slow; may come to a standstill or regress	Variable and depends on level of differentiation; the more undifferentiated the cells, the more rapid the rate of growth
Mode of growth	Grows by expansion without invading the surrounding tissues; usually encapsulated	Grows by invasion, sending out processes that infiltrate the surrounding tissues
Metastasis	Does not spread by metastasis	Gains access to blood and lymph channels to metastasize to other areas of the body



Cancer

Terminology

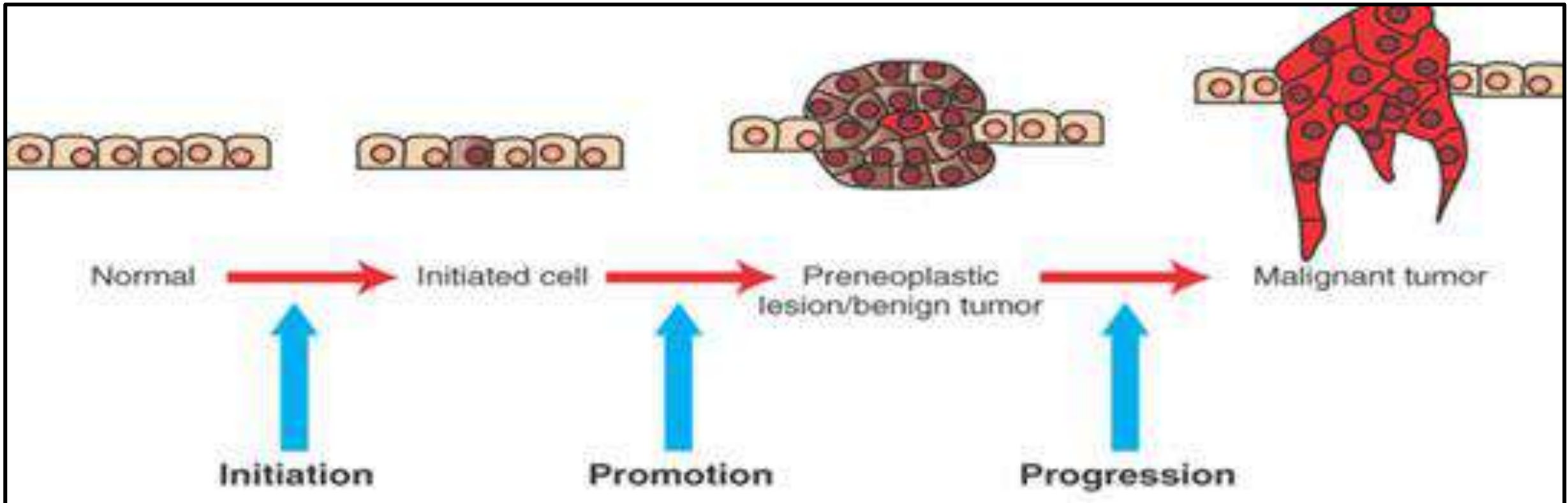
- **Cancer** oma
- **Oncology**
- **Neoplasm**
 - **Benign**
 - **Malignant**
 - **Solid cancers**
 - **Hematological cancers**
- **Neoplasia**

TISSUE TYPE	BENIGN TUMORS	MALIGNANT TUMORS
Epithelial		
Surface	Papilloma	Squamous cell carcinoma
Glandular	Adenoma	Adenocarcinoma
Connective		
Fibrous	Fibroma	Fibrosarcoma
Adipose	Lipoma	Liposarcoma
Cartilage	Chondroma	Chondrosarcoma
Bone	Osteoma	Osteosarcoma
Blood vessels	Hemangioma	Hemangiosarcoma
Lymph vessels	Lymphangioma	Lymphangiosarcoma
Lymph tissue		Lymphosarcoma
Muscle		
Smooth	Leiomyoma	Leiomyosarcoma
Striated	Rhabdomyoma	Rhabdomyosarcoma
Neural Tissue		
Nerve cell	Neuroma	Neuroblastoma
Glial tissue	Glioma	Glioblastoma, astrocytoma, medulloblastoma, oligodendroglioma
Nerve sheaths	Neurilemmoma	Neurilemmal sarcoma
Meninges	Meningioma	Meningeal sarcoma
Hematologic		
Granulocytic		Myelocytic leukemia
Erythrocytic		Erythrocytic leukemia
Plasma cells		Multiple myeloma
Lymphocytic		Lymphocytic leukemia or lymphoma

Cancer

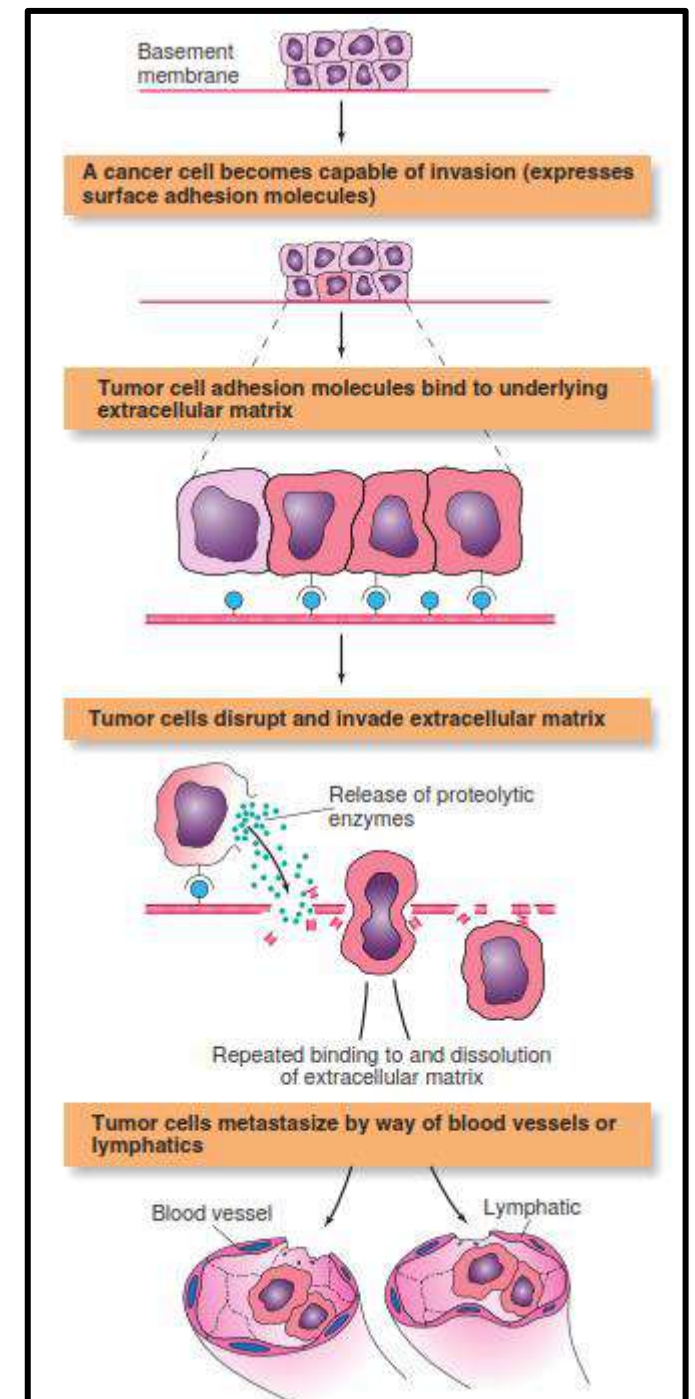
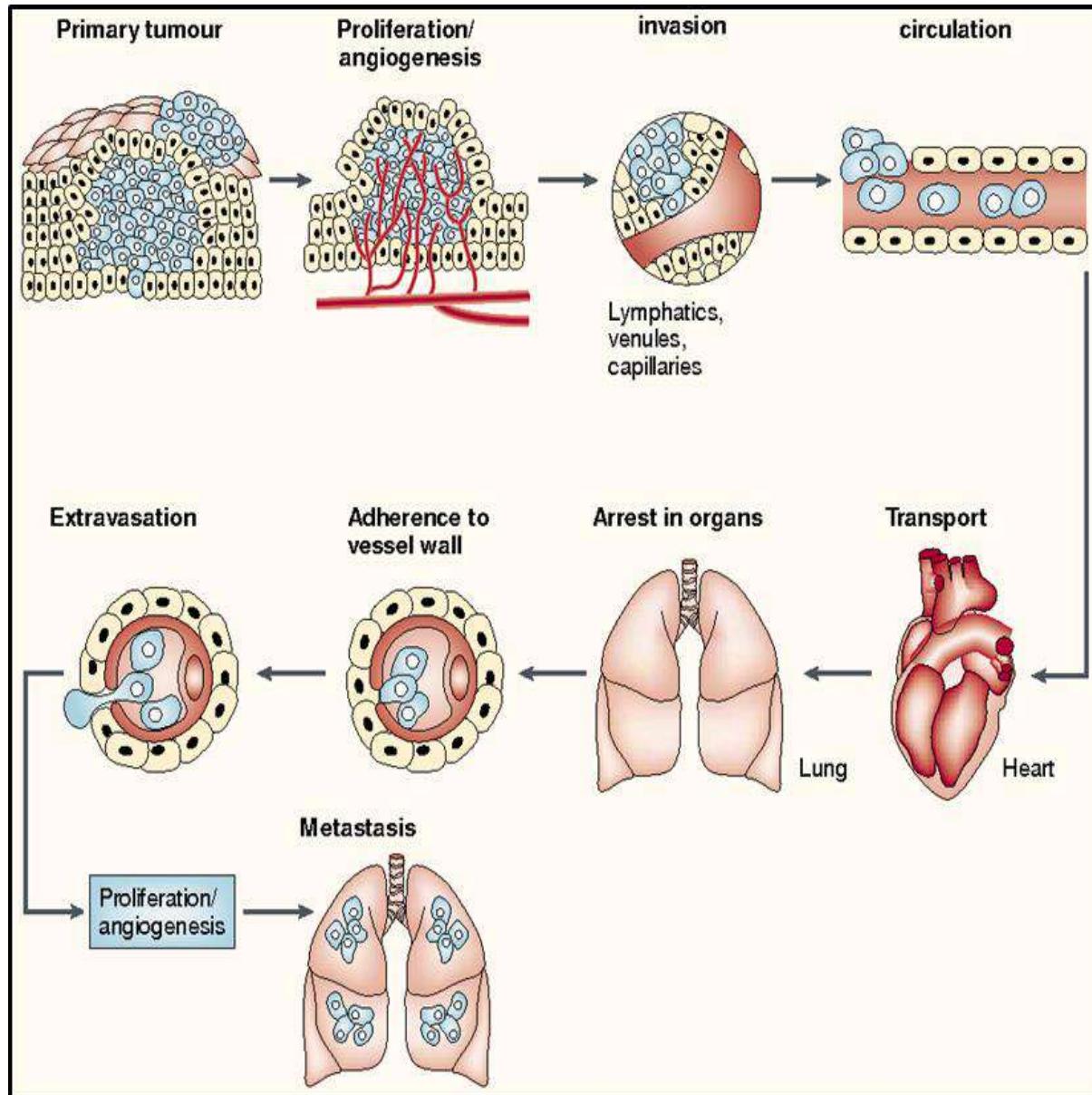
Pathogenesis

Carcinogenesis



Infiltration, invasion and metastasis

Cancer



Cancer

Causes and risk factors



Cancer

Staging and grading of cancer

- Grading: I-IV
 - Staging: American Joint Committee on Cancer (AJCC)
 - **TNM**
 - T stands for the size and local spread of the primary tumor (0-4)
 - N refers to the involvement of the regional lymph nodes (0-3)
 - M describes the extent of the metastatic involvement (0-1)
- T2N1M0** indicates a moderate-size tumor with limited lymph nodal disease and no metastasis

Cancer

Diagnosis

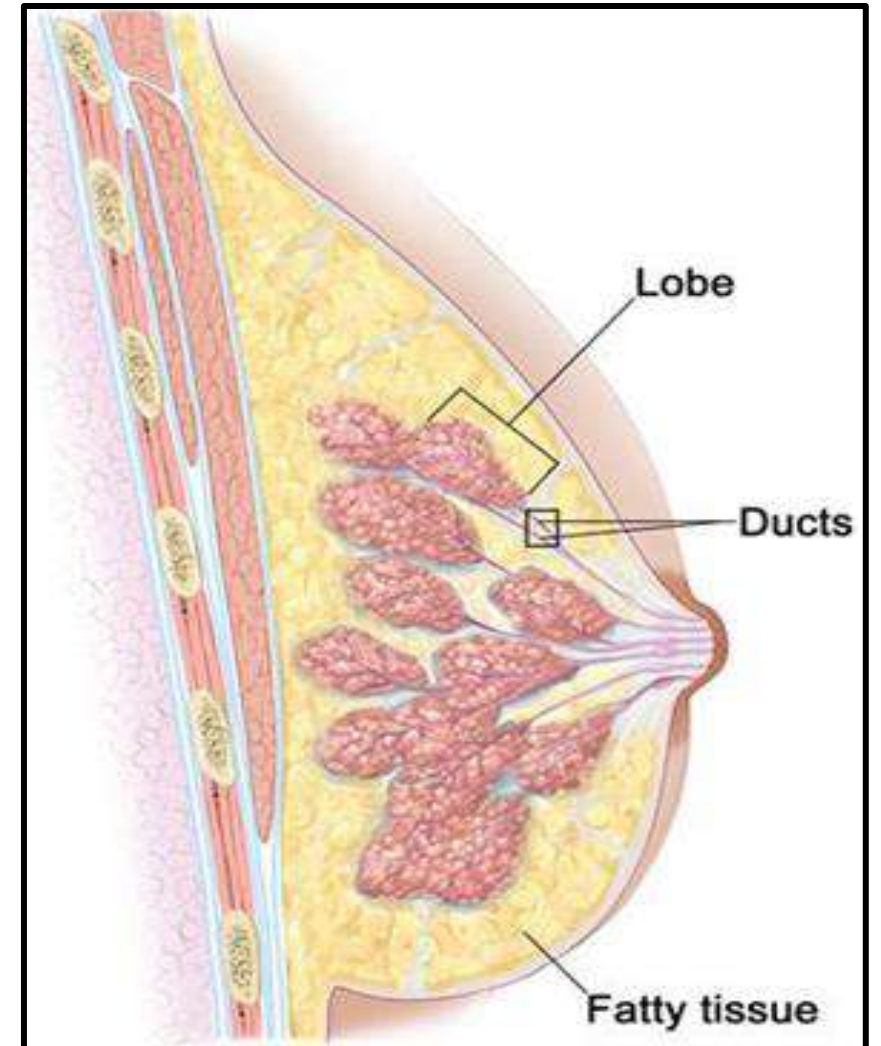
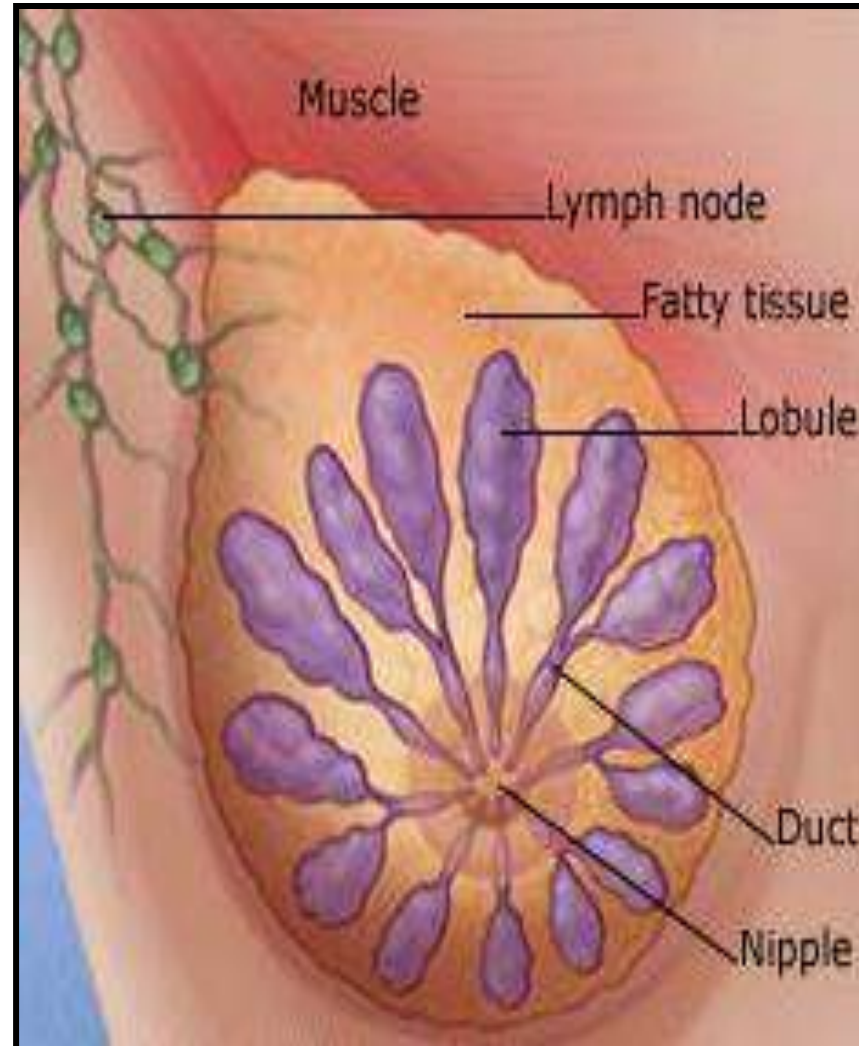
- Tumor markers (biomarkers)
- Cytological and histological methods
 - Tissue biopsy
 - Immunohistochemistry
 - Microarray technology
- Ultrasonography
- Computed tomography (CT)
- Magnetic resonance imaging (MRI)

MARKER	SOURCE	ASSOCIATED CANCERS
Antigens		
AFP	Fetal yolk sac and gastrointestinal structures early in fetal life	Primary liver cancers; germ cell cancer of the testis
CA 15-3	Breast tissue protein	Tumor marker for tracking breast cancer; liver, lung
CA 27.29	Breast tissue protein	Breast cancer recurrence and metastasis
CEA	Embryonic tissues in gut, pancreas, liver, and breast	Colorectal cancer and cancers of the pancreas, lung, and stomach
Hormones		
hCG	Hormone normally produced by placenta	Gestational trophoblastic tumors; germ cell cancer of testis
Calcitonin	Hormone produced by thyroid parafollicular cells	Thyroid cancer
Catecholamines (epinephrine, norepinephrine) and metabolites	Hormones produced by chromaffin cells of the adrenal gland	Pheochromocytoma and related tumors
Specific Proteins		
Monoclonal immunoglobulin	Abnormal immunoglobulin produced by neoplastic cells	Multiple myeloma
PSA	Produced by the epithelial cells lining the acini and ducts of the prostate	Prostate cancer
Mucins and Other Glycoproteins		
CA-125	Produced by müllerian cells of ovary	Ovarian cancer
CA-19-9	Produced by alimentary tract epithelium	Cancer of the pancreas, colon
Cluster of Differentiation		
CD antigens	Present on leukocytes	Used to determine the type and level of differentiation of leukocytes involved in different types of leukemia and lymphoma

Solid Cancer

Breast cancer

- Definition

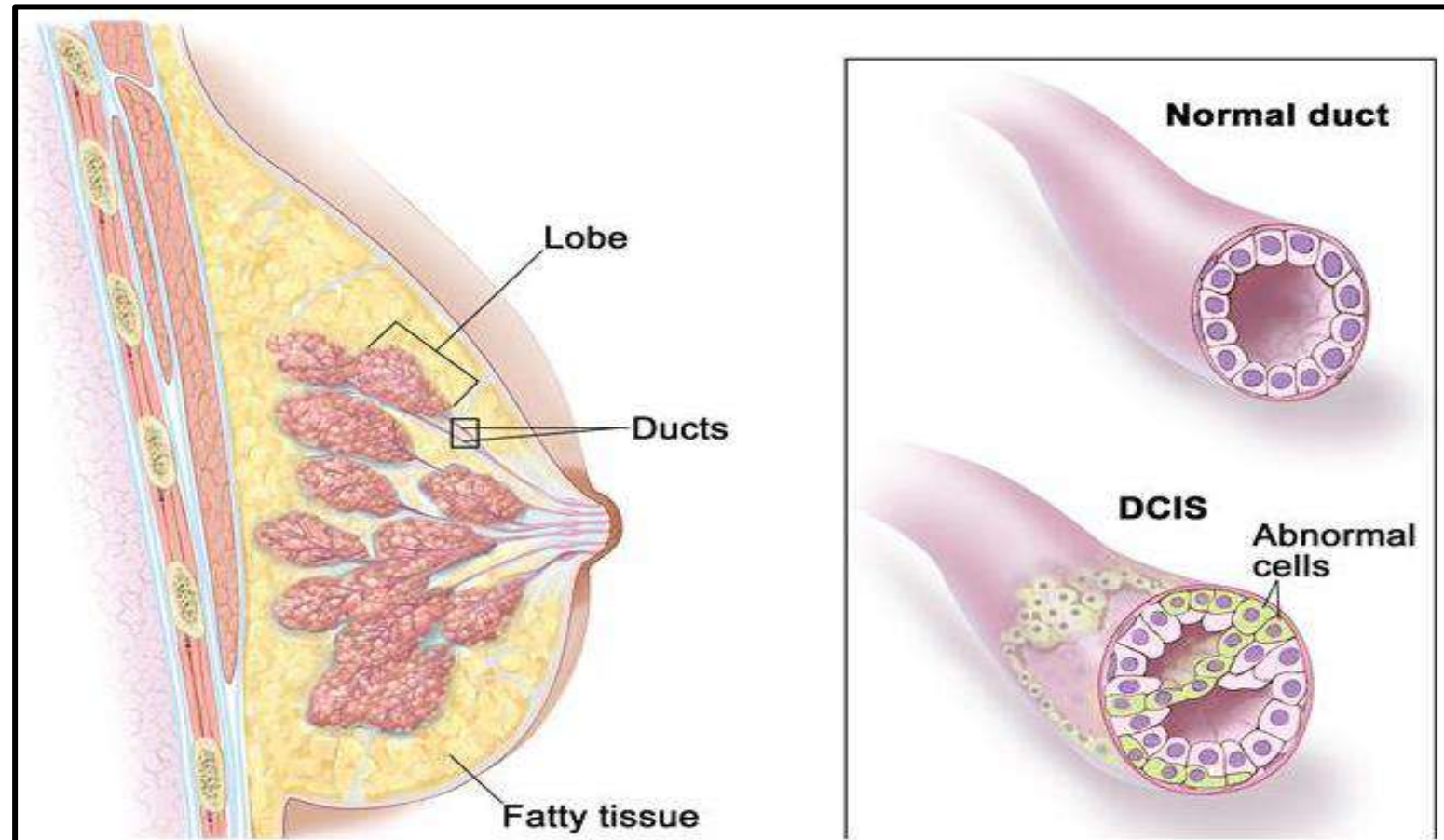


Solid Cancer

Breast cancer

- Ductal carcinoma
- Lobular carcinoma

1. *Ductal carcinoma in situ (DCIS)*

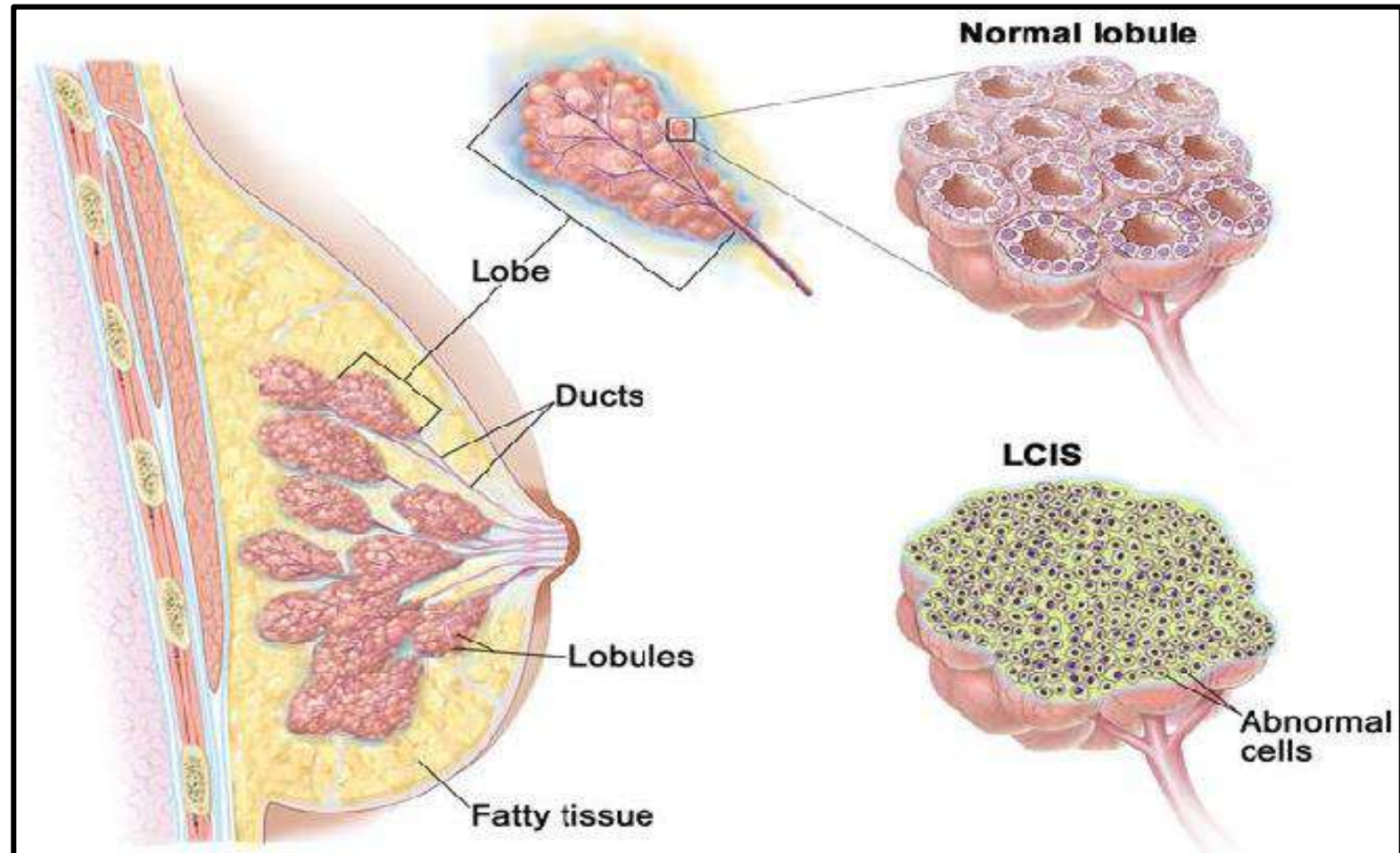


Solid Cancer

Breast cancer

- Ductal carcinoma
- Lobular carcinoma

2. *Lobular carcinoma in situ (LCIS)*

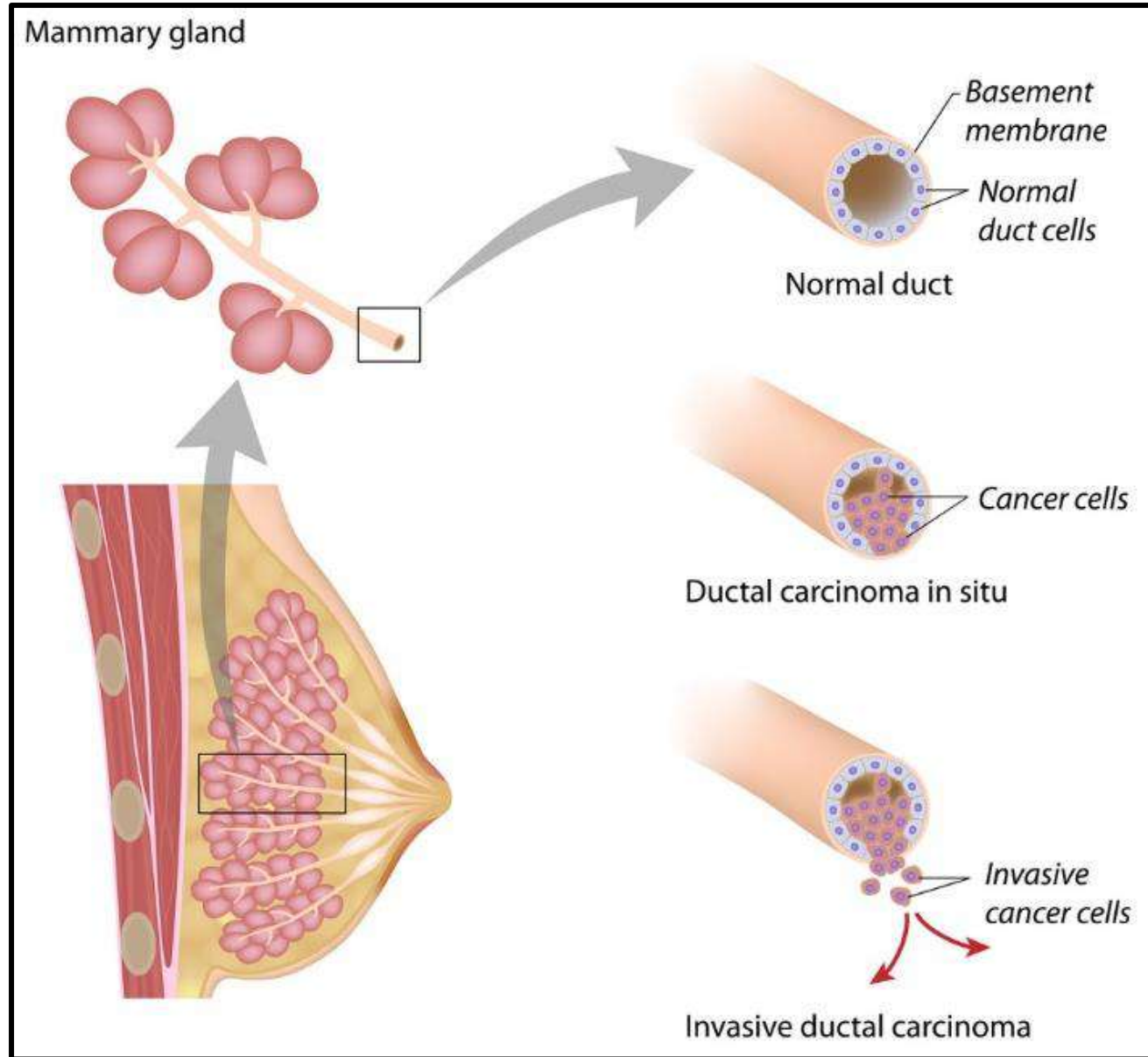


Solid Cancer

Breast cancer

- Ductal carcinoma
- Lobular carcinoma

3. Invasive ductal carcinoma (IDC)

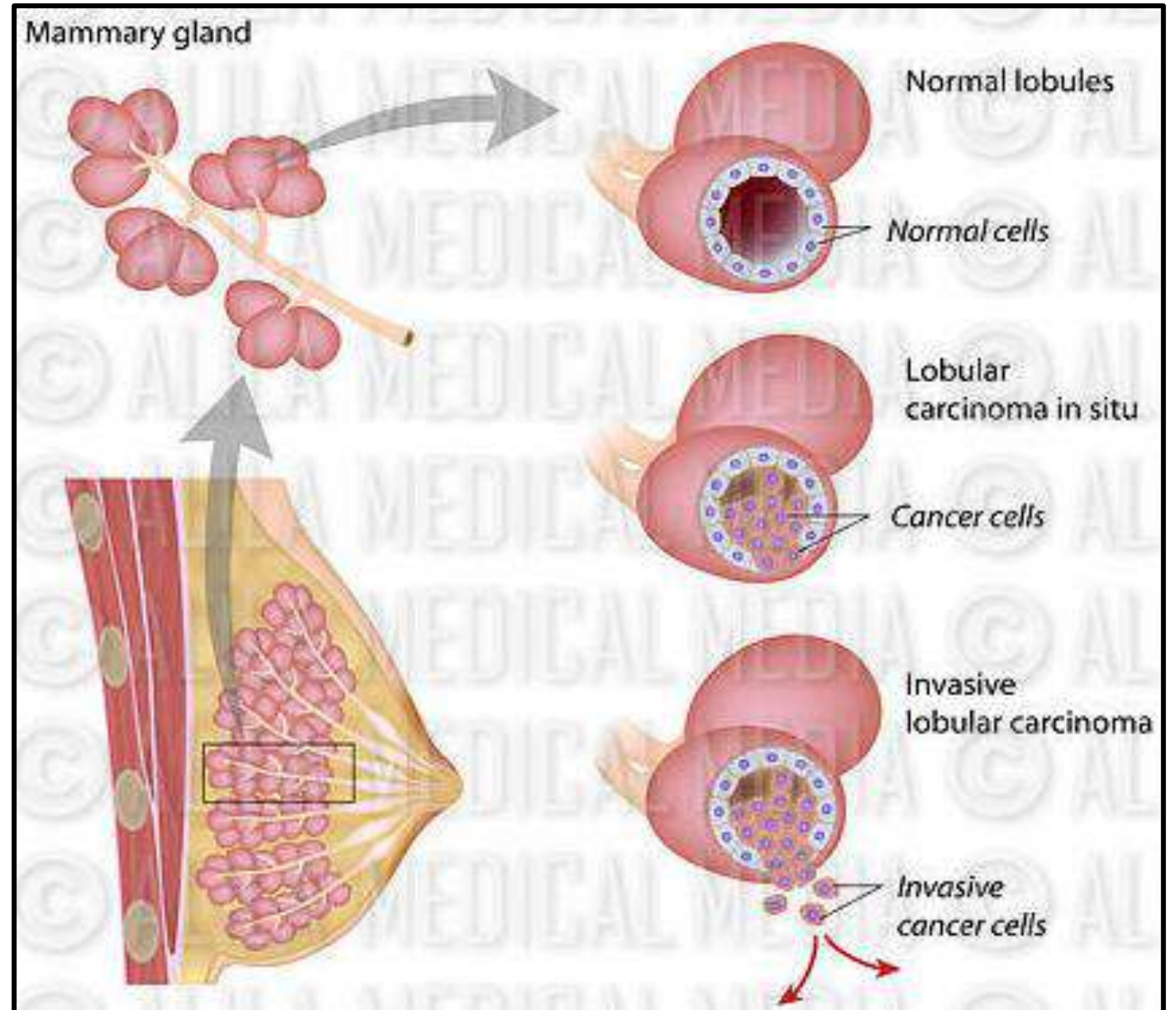


Solid Cancer

Breast cancer

- Ductal carcinoma
- Lobular carcinoma

4. Invasive lobular carcinoma (ILC)



Solid Cancer

Breast cancer

- Ductal carcinoma
- Lobular carcinoma

5. Inflammatory breast cancer (IBC)

6. Triple-negative breast cancer (TNBC)

Solid Cancer

Breast cancer

Risk factors

- Age and gender
- Family history
- Personal history of breast cancer
- Menstrual cycle
- Childbirth
- Hormone replacement therapy (HRT) or oral contraceptives
- Obesity
- Radiation
- Benign breast tumor

Solid Cancer

Breast cancer

Symptoms

- Painless (when present deeply, painful superficially), hard mass that has irregular edges, but sometimes it can be soft, and rounded.
- Swelling of all or part of the breast
- Skin dimpling
- Breast or nipple pain
- Nipple retraction (turning inward)
- Redness, or thickening of the nipple or breast skin
- Nipple discharge (may be bloody, clear to yellow, green and look like pus)
- Skin ulcers
- Swelling of one arm (beside the breast with cancer)

Solid Cancer

Malignant breast tumors

Staging

- a. Stage 0
- b. Stage 1
- c. Stage 2
- d. Stage 3
- e. Stage 4

Solid Cancer

Breast cancer

Diagnosis

- **Breast self-exam (BSE)**
- **Clinical breast exam (CBE)**
- **Mammography**
- **Breast ultrasound (sonography)**
- **Magnetic resonance imaging (MRI)**
- **Biopsy**
 - Excisional biopsy
 - Incisional biopsy
 - Core biopsy
 - Fine-needle aspiration (FNA) biopsy
- **Immunohistochemistry: Estrogen, progesterone, HER2 receptors**
- **Microarray**
- **Tumor markers: CA-15-3 and CA-27-29**

Solid Cancer

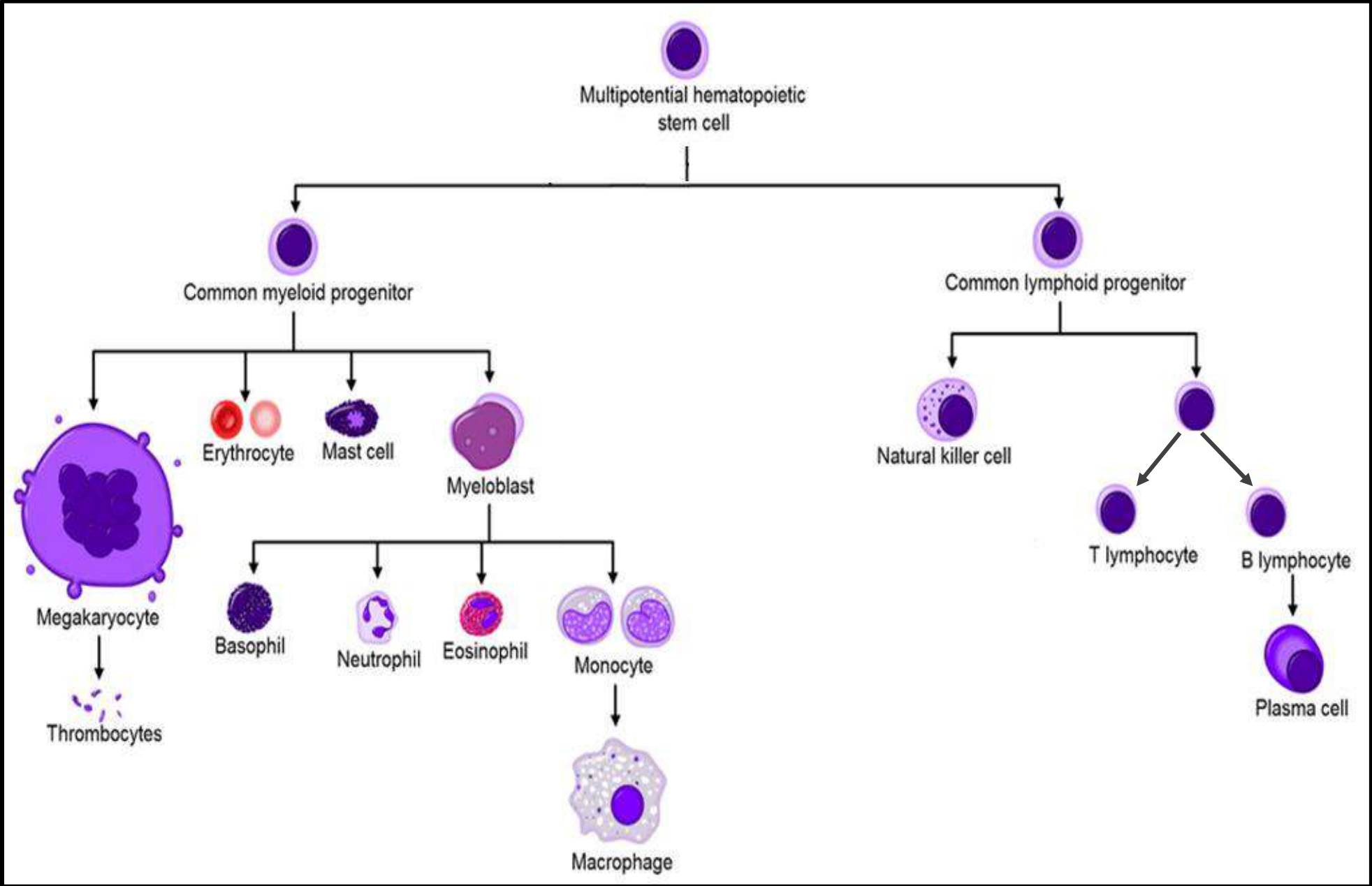
Breast cancer

Treatment

- **Surgery**
 - **Breast-conserving surgery**
 - Lumpectomy
 - Partial mastectomy
 - **Total mastectomy**
 - **Modified radical mastectomy**
- **Radiation therapy:** external or internal
- **Anticancer drugs**
 - Chemotherapy, TAC: paclitaxel, doxorubicin (Adriamycin), and cyclophosphamide
 - Hormonal therapy: Tamoxifen and Aromatase inhibitors (AIs)
 - Targeted therapy: Trastuzumab (monoclonal antibody of HER2)

Hematological Malignancies

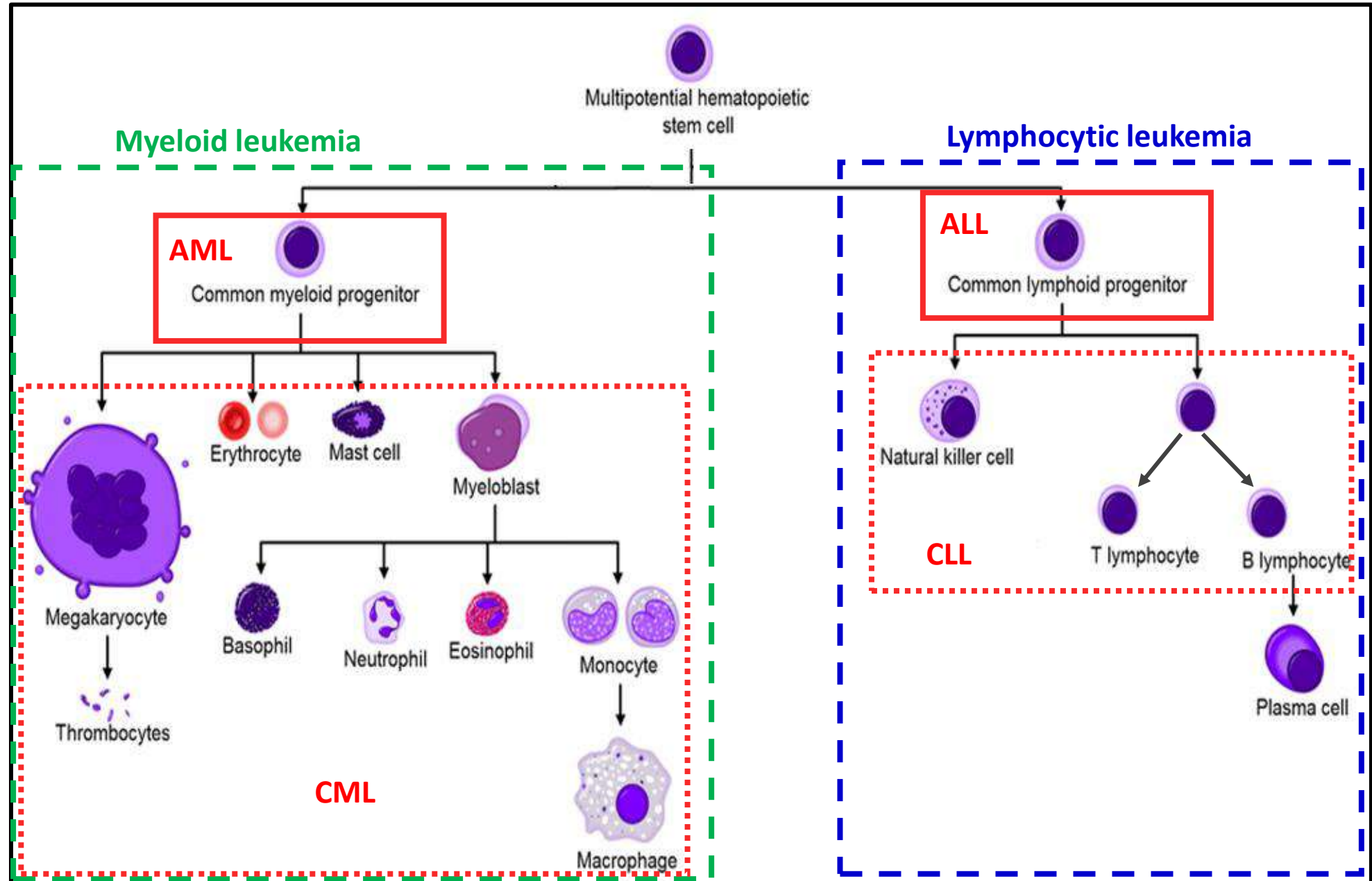
- Definition
- Types



Hematological Malignancies

Leukemia

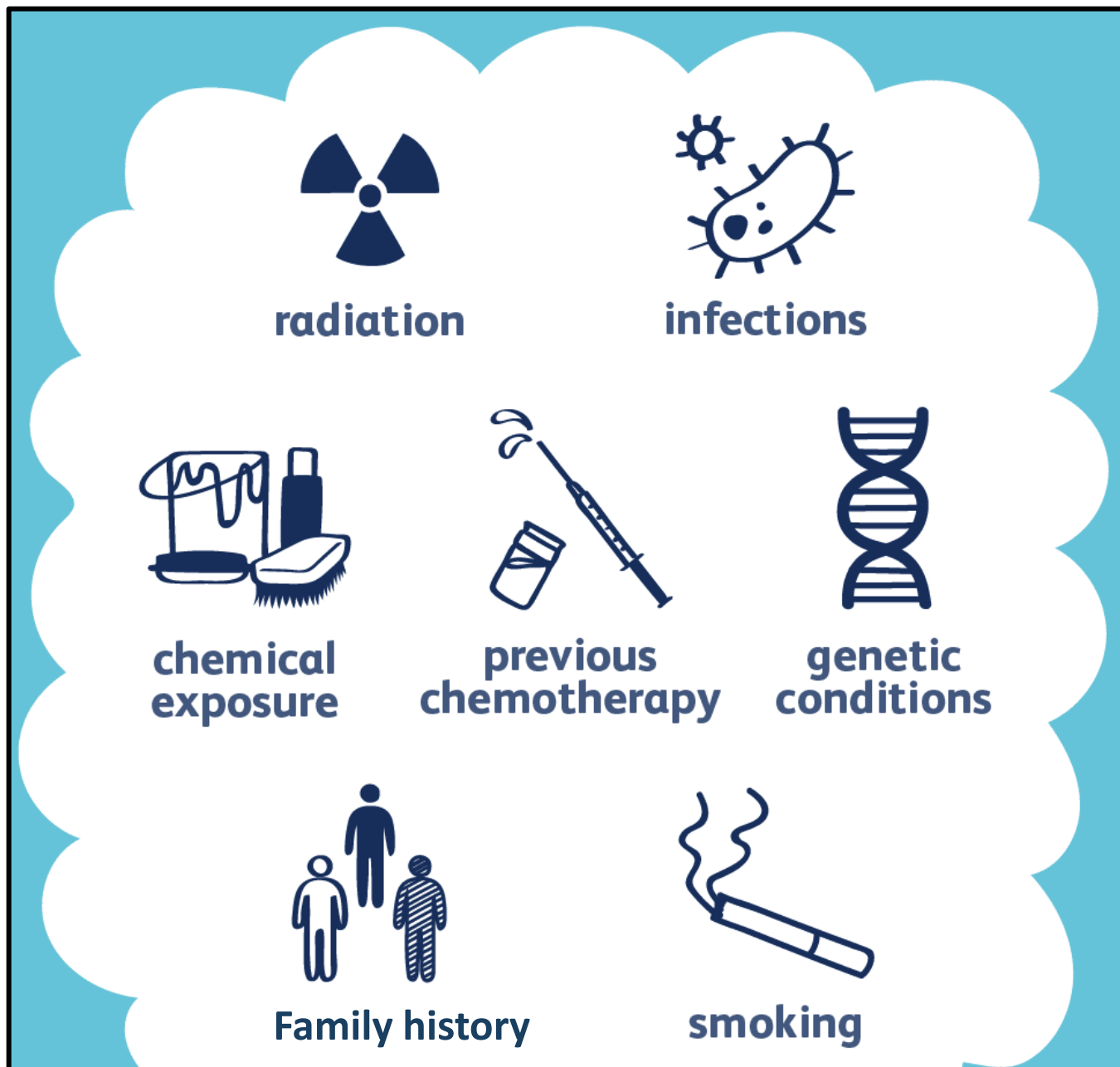
- Definition
- Types



Hematological Malignancies

Leukemia

- Causes and risk factors



Hematological Malignancies

Leukemia

- Symptoms

The image displays eight distinct symptoms of leukemia, each with a corresponding illustration or photograph:

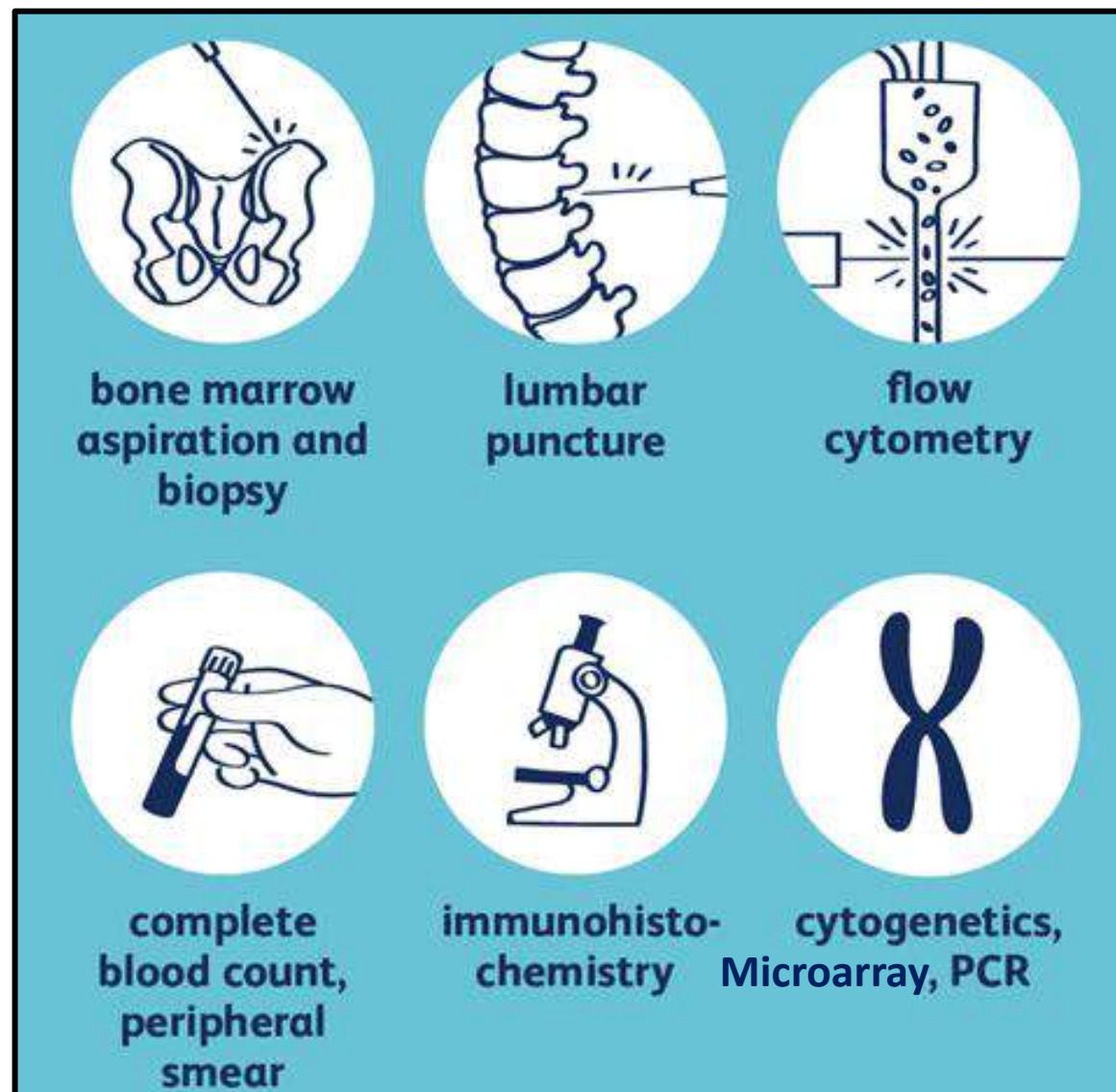
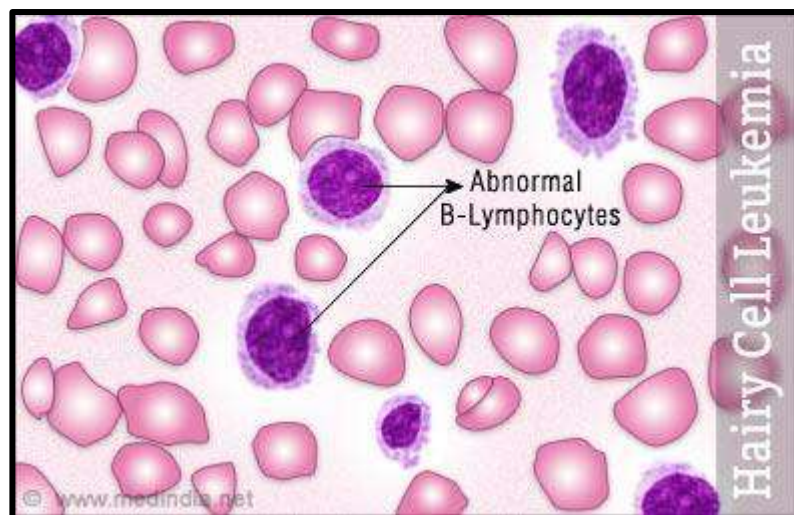
- Swollen lymph nodes:** A diagram of a human neck showing a significantly enlarged lymph node in the neck area, labeled "Swollen lymph node", and a smaller, normal-sized lymph node labeled "Normal lymph node".
- Fever:** A cartoon illustration of a person with a fever, shown with a thermometer in their mouth and a red glow on their face.
- Night sweats:** A photograph of a person sitting up in bed, looking distressed, with a red glow on their face indicating a fever or night sweats.
- Nose bleeds:** A photograph of a person using a tissue to wipe their nose, indicating a nosebleed.
- Severe infections:** A close-up photograph of a person's mouth showing a severe, bloody infection on the tongue and throat.
- Bleeding easily:** A diagram showing a hand with a cut on the wrist. The cut is bleeding profusely, with labels for "ARTERIES", "VEINS", and "CAPILLARIES".
- Bone pain:** A photograph of a person's hands clasped over their knees, with a red glow on the knees indicating bone pain.
- Red spots on skin:** A photograph of a person's arm showing several small, red, raised spots on the skin.
- Weight loss:** A photograph of a person's waist showing a significant amount of weight loss, with their pants hanging loosely.

Anemia
Fatigue

Hematological Malignancies

Leukemia

- Diagnosis



Hematological Malignancies

Leukemia

- **Treatment**

1. **Chemotherapy**

- a. **Remission induction therapy**

- b. **Consolidation therapy**

- c. **Maintenance therapy**

2. **Radiation therapy**

3. **Hematopoietic stem cell transplantation (HSCT):** autologous SCT (auto-SCT) and allogeneic SCT (allo-SCT)

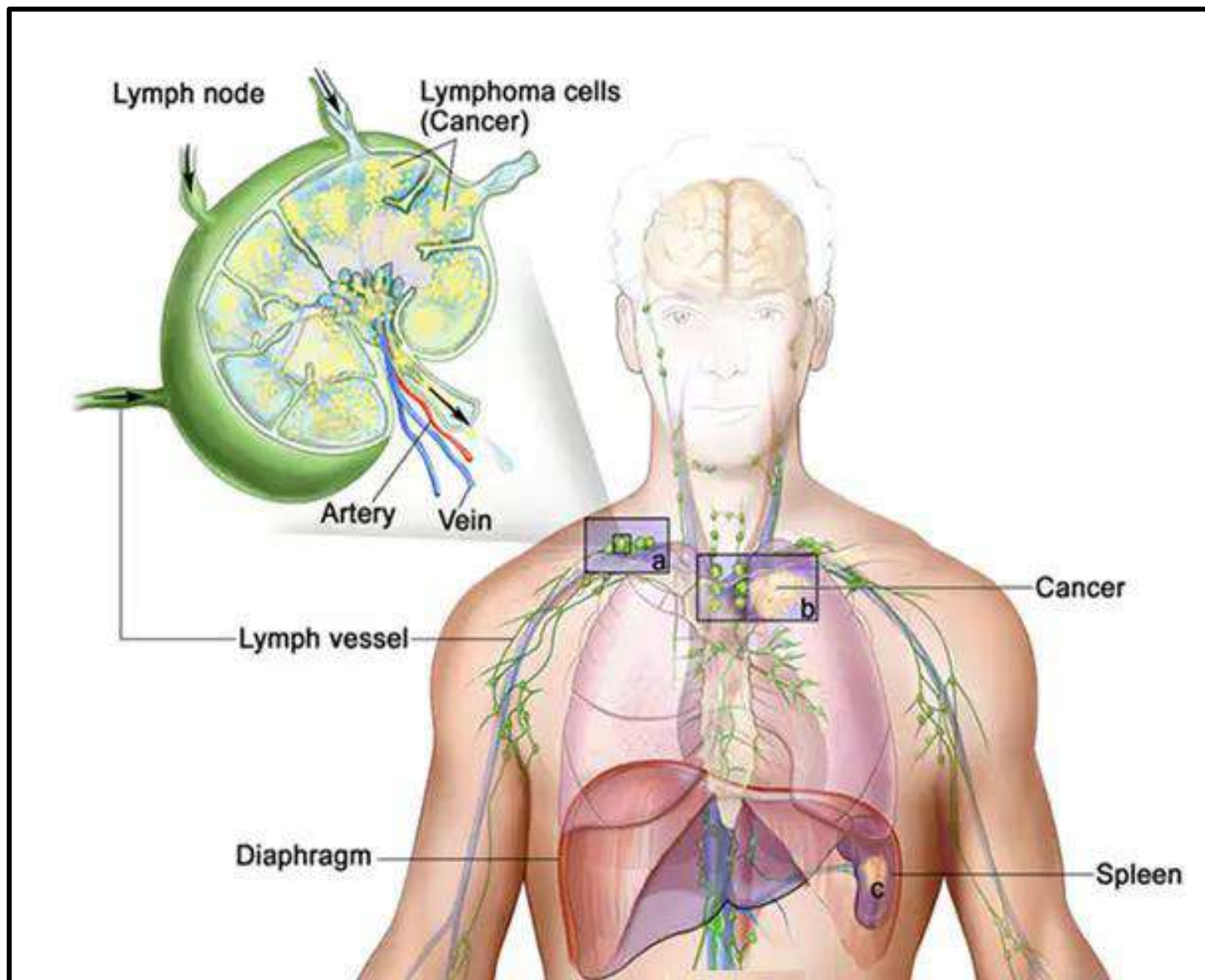
4. **Immunotherapy**

5. **Targeted therapy**

Hematological Malignancies

Lymphoma

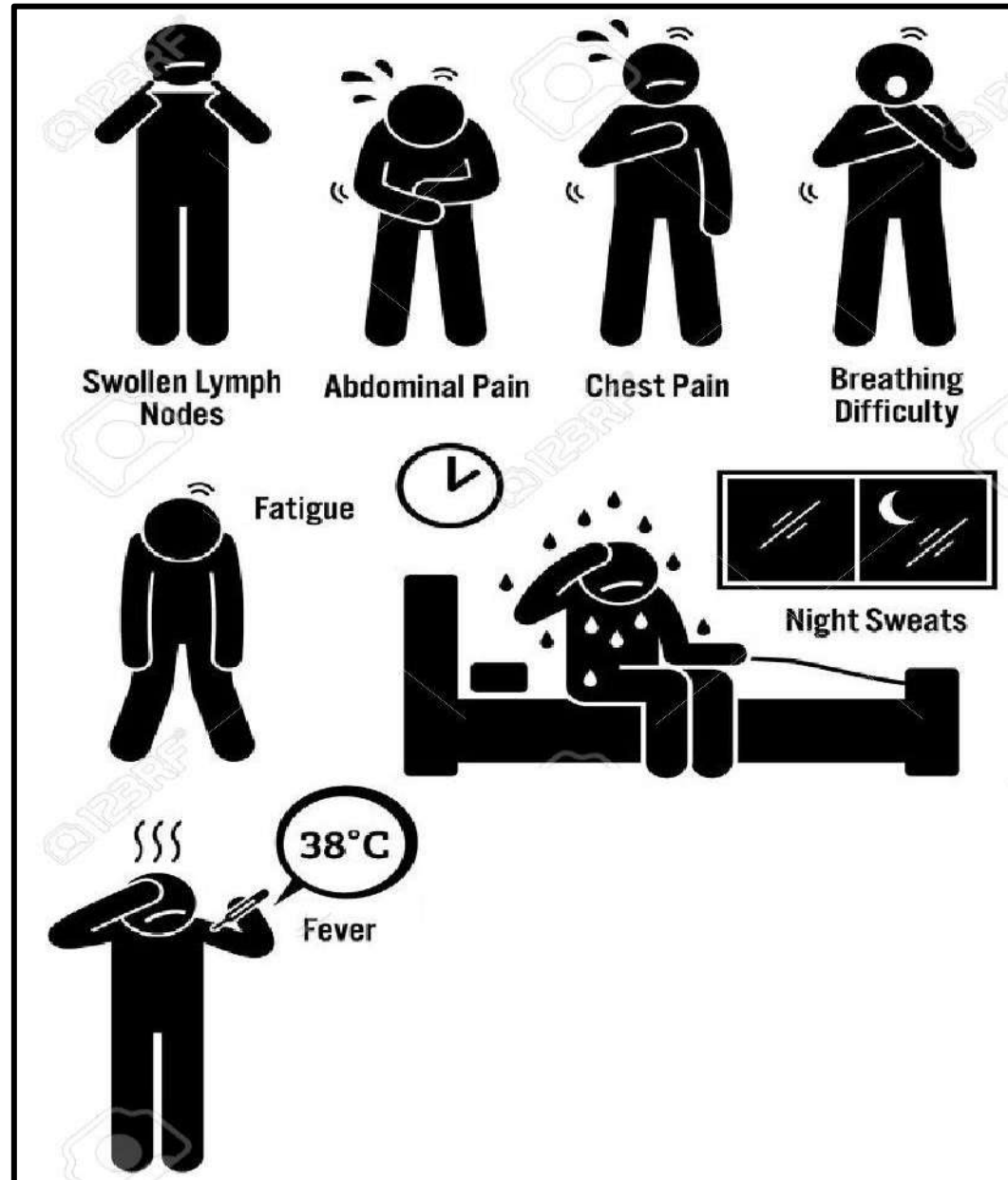
- Definition
- Types
 - Hodgkin lymphoma (HL)
 - Non-Hodgkin lymphoma (NHL)



Hematological Malignancies

Lymphoma


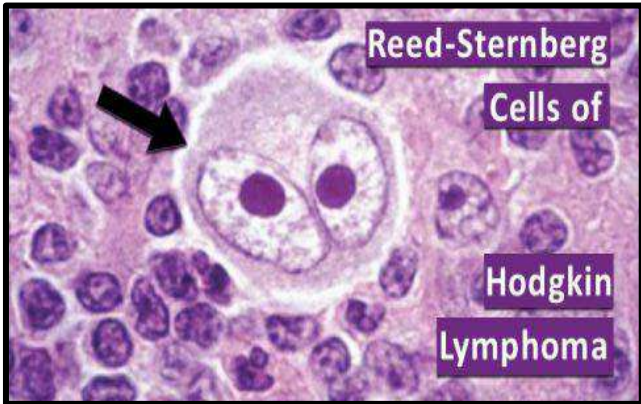
- Symptoms



Hematological Malignancies

Lymphoma

- Diagnosis



Physical exam



Biopsy



Imaging tests



Blood tests

A composite image within a black border showing four diagnostic methods: 1. Physical exam: A doctor in a white coat examines a patient's neck. 2. Biopsy: A gloved hand uses a needle to sample a red, textured organ. 3. Imaging tests: A CT scanner in a clinical setting. 4. Blood tests: A gloved hand holds a test tube with red liquid next to a microscope.

Hematological Malignancies

Lymphoma

- **Treatment**

1. **Chemotherapy**
2. **Radiation therapy**
3. **Hematopoietic stem cell transplantation (HSCT):** autologous SCT (auto-SCT) and allogeneic SCT (allo-SCT)
4. **Immunotherapy**
5. **Targeted therapy**