STUDY UNIT 5: CANCER GENETICS AND GENOMICS

TEXTBOOK CHAPTER 10

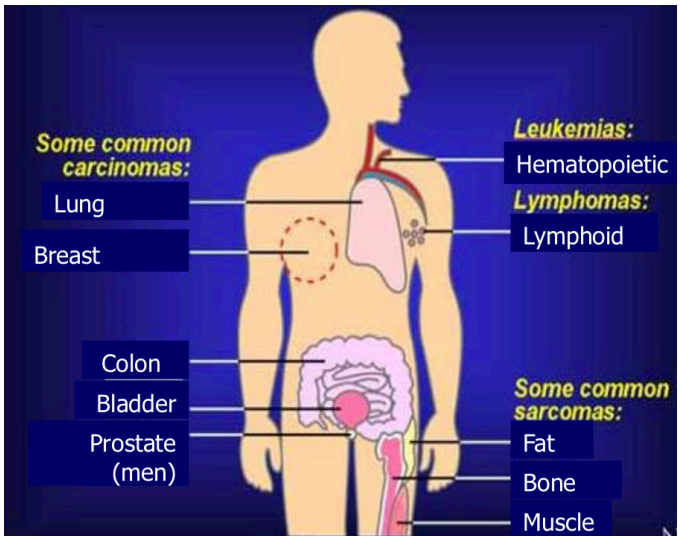
LECTURE 1

1) FUNDAMENTAL CHARACTERISTICS AND EVOLUTION OF CANCER

- **Cancer:** A heterogenous group of disorders whose common features are uncontrolled cell growth and cell spreading ; abnormal cells are formed that can invade adjacent tissues and spread to other parts of the body through the blood and lymph systems.
  - ➢ The general process of cancer formation is known as *carcinogenesis*.
  - ➢ Cancer is a consequence of genetic damage whose cumulative effect results in unrestrained cell growth, tissue invasion, and metastasis

- Aberrant regulation of cell growth results in an abnormal increase in cell numbers; growths can result that appear normal or abnormal.
  - ➢ A growth containing excessive numbers of cells that appear to be virtually the same as those in the normal tissue is said to be ***hyperplastic***
  - ➢ A growth that has cytologically abnormal cells is said to be ***dysplastic*.**

Main forms of cancer



TISSUE/CELLS OF ORIGIN	TUMORS
Epithelial tissue (single-layer or bilayer)	adenoma (benign); adenocarcinoma (malignant)
Epithelial tissue (multi-layer, as in skin and bladder)	papilloma (benign); squamous cell carcinoma (malignant, in skin); transitional cell carcinoma (malignant, in bladder)
Blood forming tissue (notably bone marrow)	lymphoma (of lymphocytes); leukemia (of leukocytes)
Stromal (mesenchymal) tissue	–oma (benign) or –sarcoma (malignant)[a]
Glial cells	Gliomas

Sarcoma ➔ Mesenchymal tissue

Carcinoma ➔ Epithelial tissue

Hematopoietic & lymphoid ➔Leukemia and Lymphoma

Cells in the body are programmed to:

- Develop
- Grow
- Differentiate (into mature cells) and also die
  - ➢ In response to a complex system of biochemical signals

Cancer results from the emergence of a clone of cells:

- Freed of programmed constraints
  - Disruption of orderly and regulated cycle of cell replication and division
- That are capable of inappropriate proliferation
  - Cancer cells duplicate and divide more frequently than neighboring cells

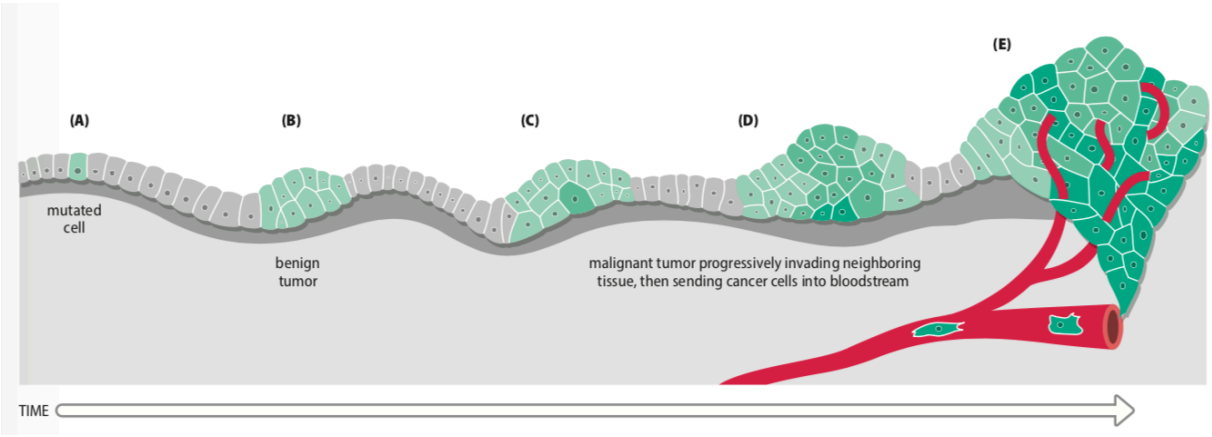
Benign tumor: Growth formed by excessive cell proliferation is localized ; the tumor is self-limiting and grows slowly and can often be surgically removed with low risk of recurrence

- They grow quite large over time and simply by expanding they can press on neighbouring structures and cause disease.

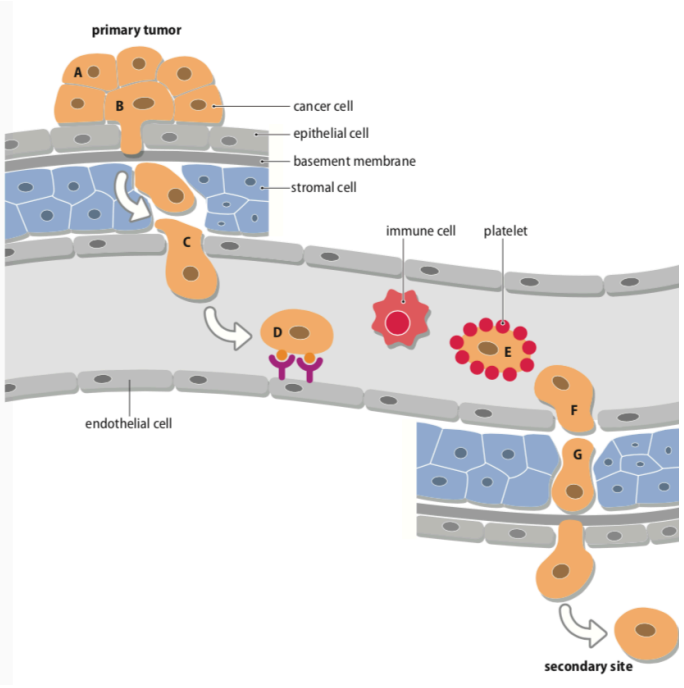
Malignant tumor: Cancers which spread. They have 2 distinguishing features:

1. They can invade neighboring tissues
2. Cells can break away and enter the lymphatic system or bloodstream to be carried to another location where they cross back into tissues to form secondary tumors.

<u>Progressive changes in the formation of malignant tumors</u>



- The initial mutated cell (A) can develop into a benign tumor (B) through the loss of some normal controls on cell division.
- Subsequent DNA and epigenetic changes can cause tumor cells to lose further normal controls to become a malignant tumor (C to E) that aggressively invades neighboring tissue.
- Cells from the malignant tumor can detach themselves and enter the bloodstream or the lymphatic system. In this way they are carried to remote sites in the body where they can exit the circulation and invade neighboring tissues to establish secondary tumors.



<u>The multiple steps taken by metastatic cells to seed secondary tumors</u>

Metastatic cells must first break free from the primary tumor , to accomplish this cancer cells:

(A) Reduce adhesion to neighbouring cells