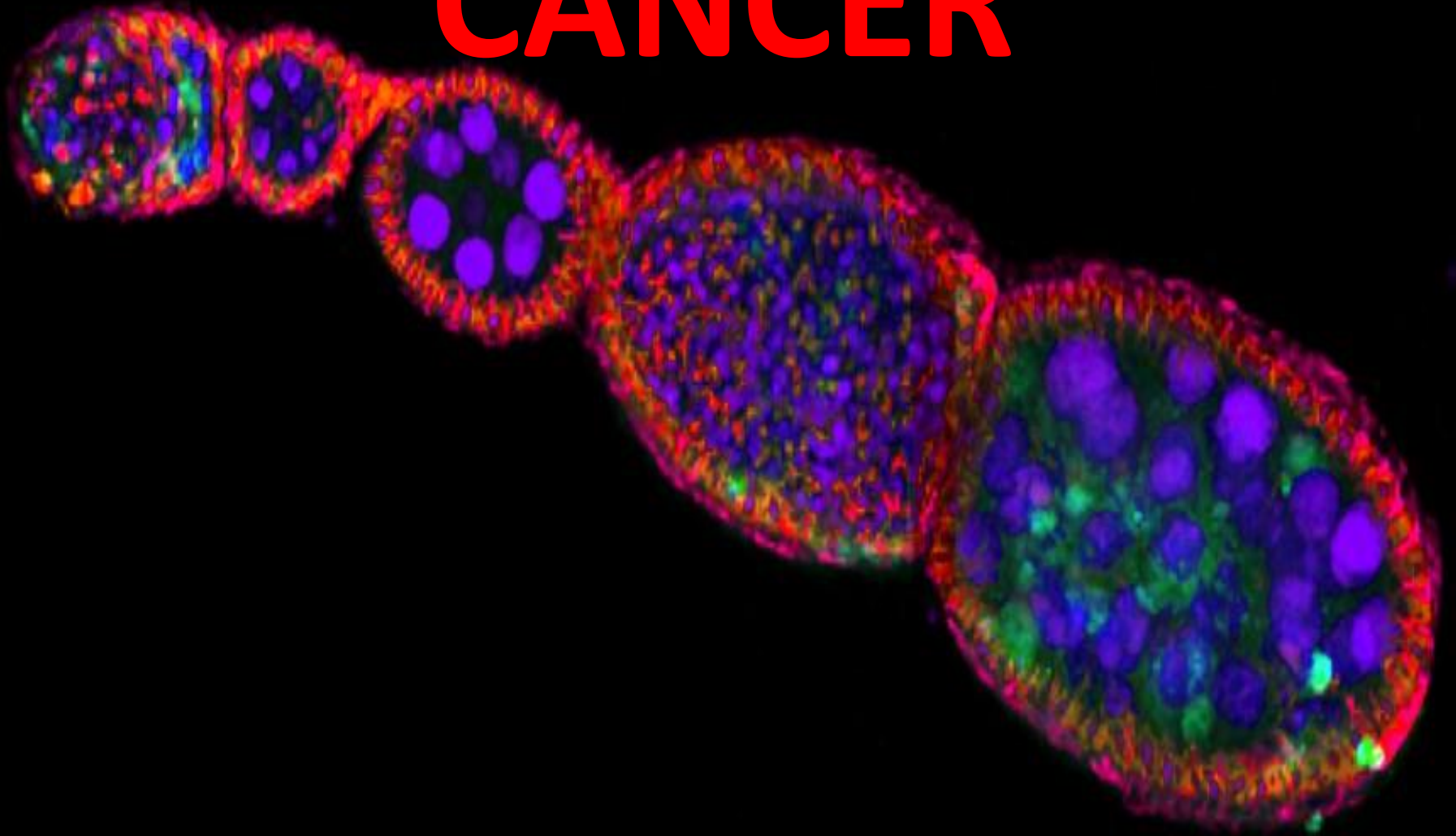


Medical Biology

BIOLOGY OF CANCER

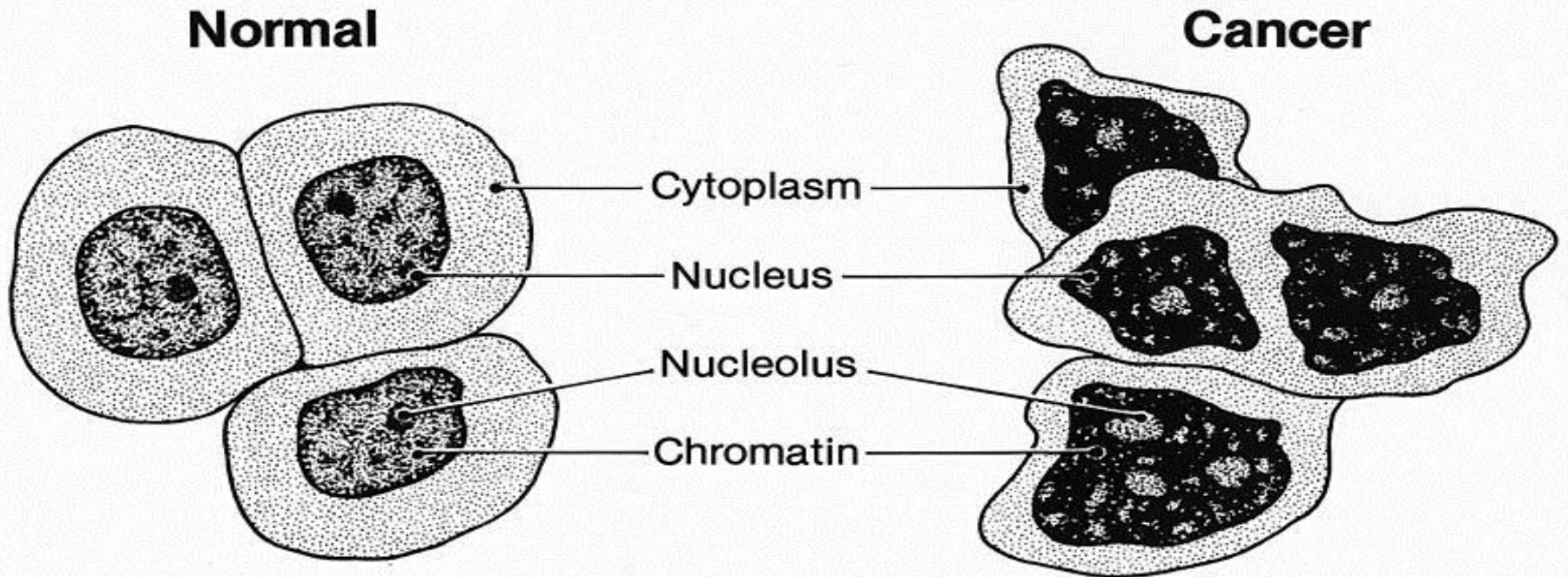


Cancer is disease characterized by uncontrolled cell growth.

- **Characteristics of Cancer Cells:**
- 1) Lack of Differentiation
- **Differentiation** is the process of cellular development by which a cell acquires a specific structure and function.

2) Abnormal Nuclei

Normal and Cancer Cells Structure



Normal

Cancer

Cytoplasm

Nucleus

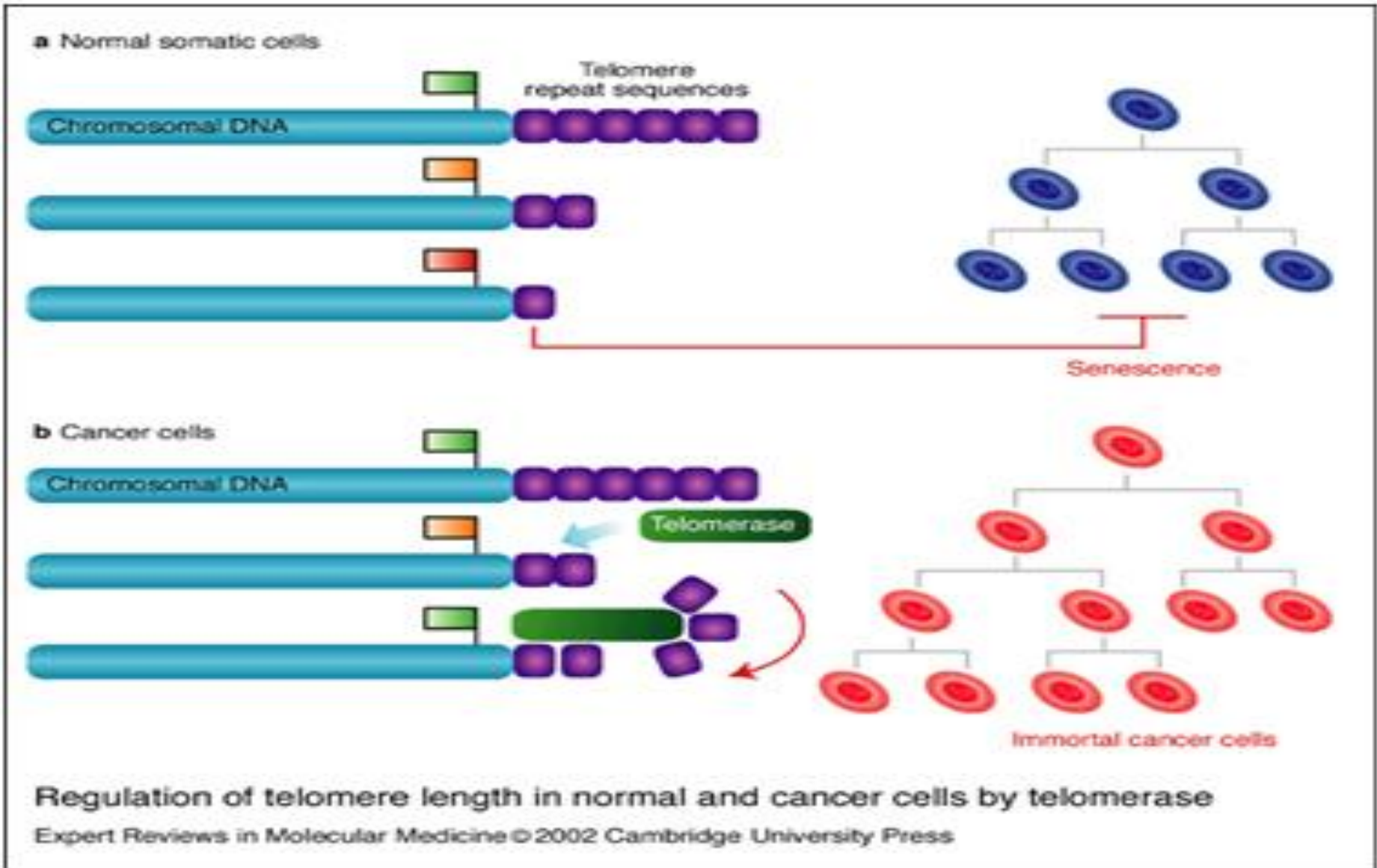
Nucleolus

Chromatin

- Large cytoplasm
- Single nucleus
- Single nucleolus
- Fine chromatin

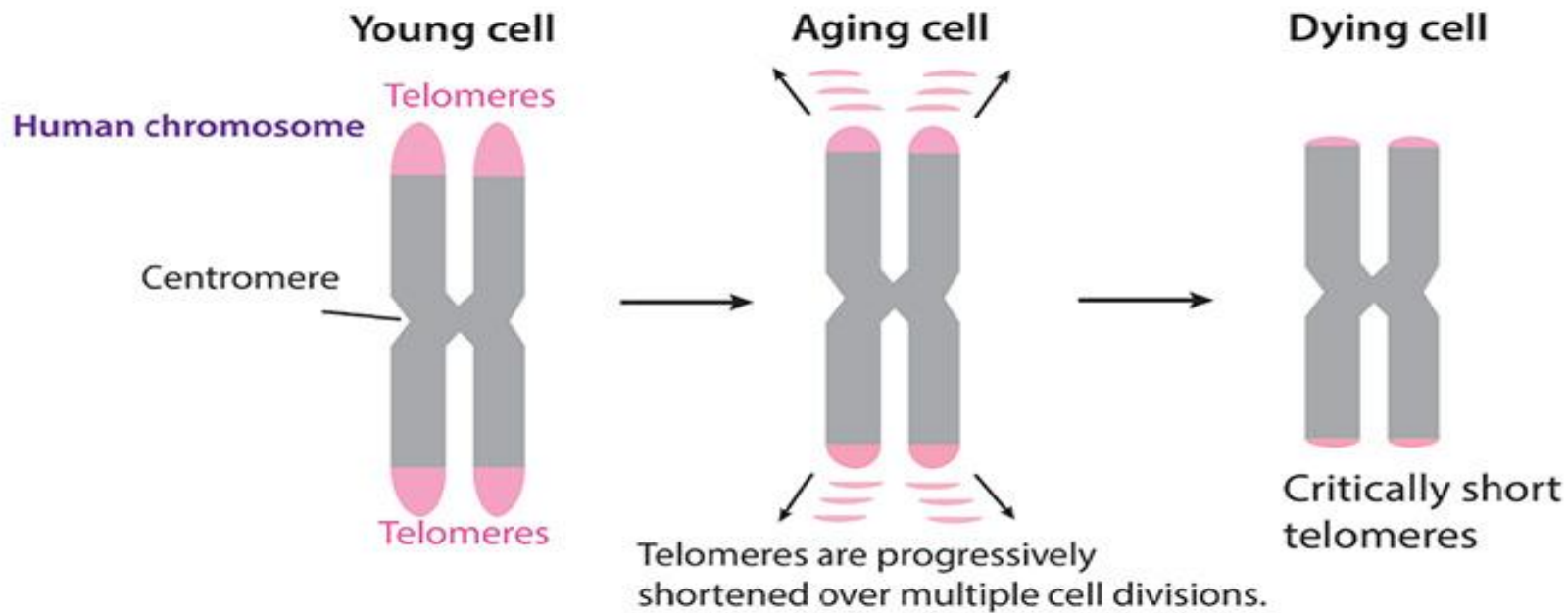
- Small cytoplasm
- Multiple nuclei
- Multiple and large nucleoli
- Coarse chromatin

3) Unlimited Replication Potential

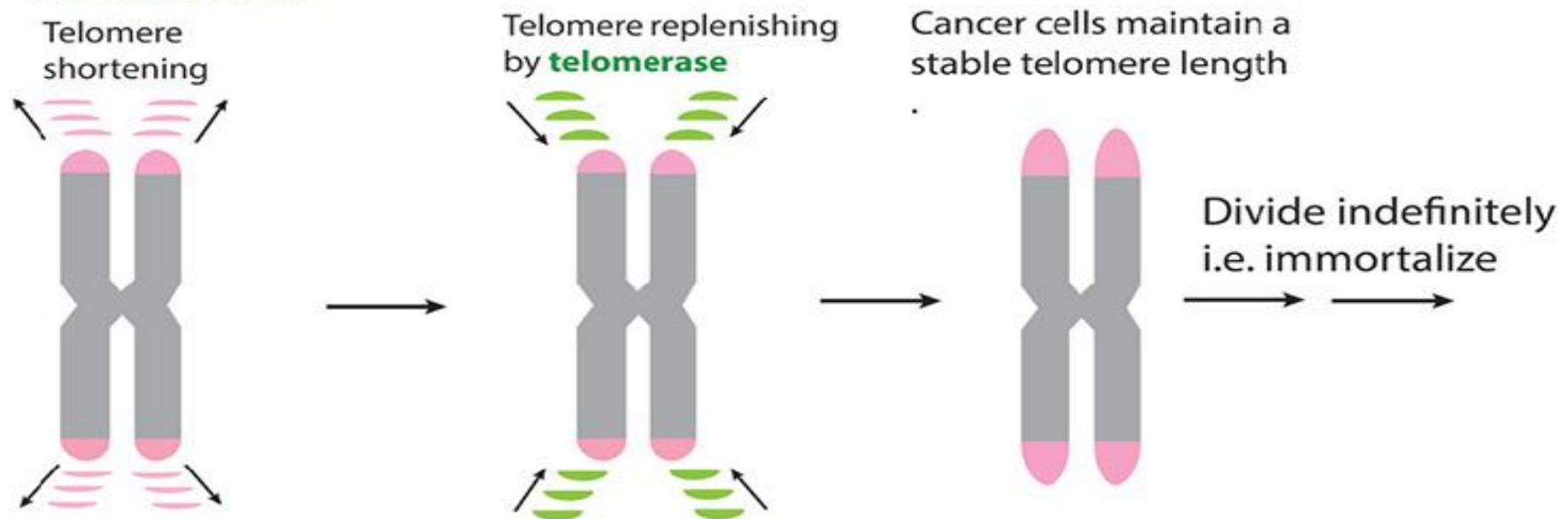


Regulation of telomere length in normal and cancer cells by telomerase

In normal cells



In cancer cells

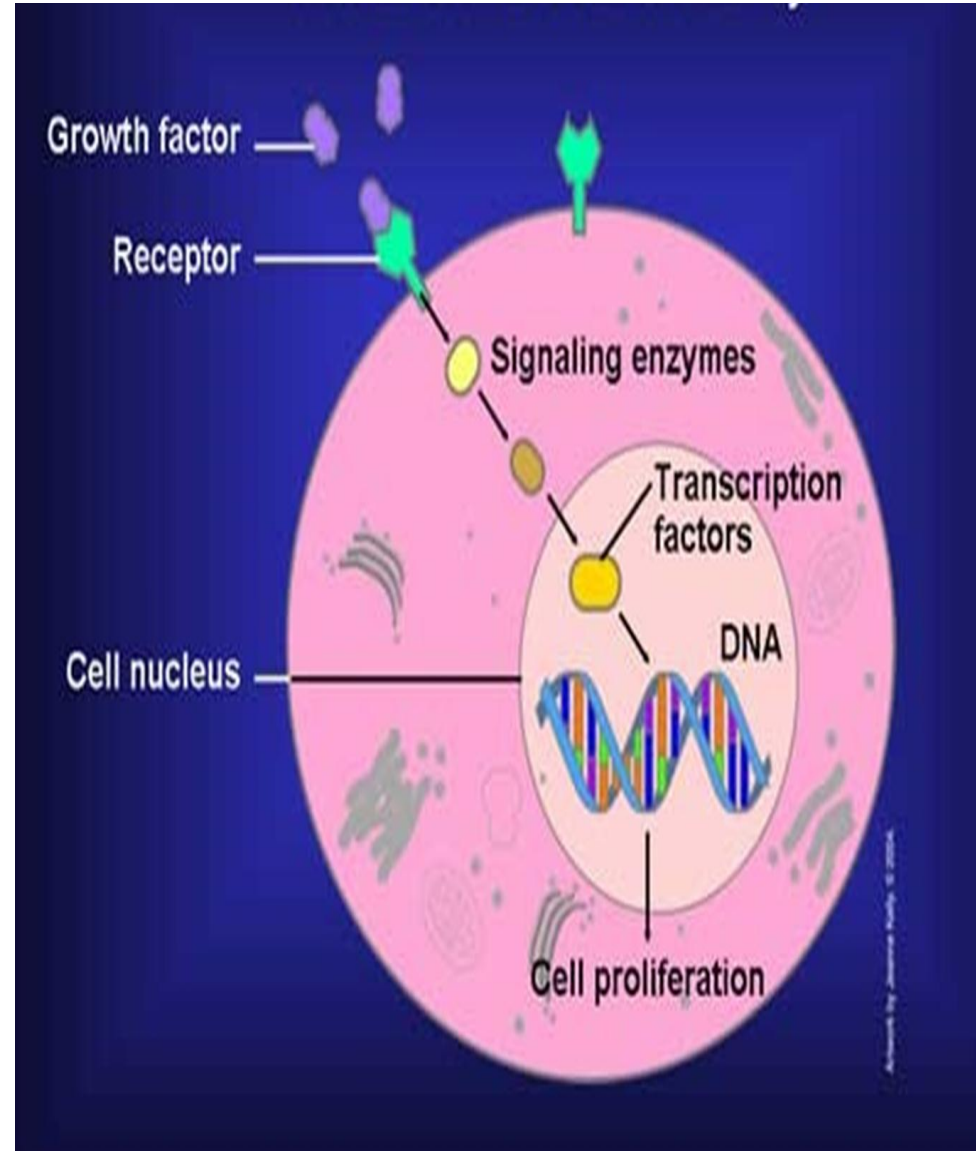


4) Tumours Formation

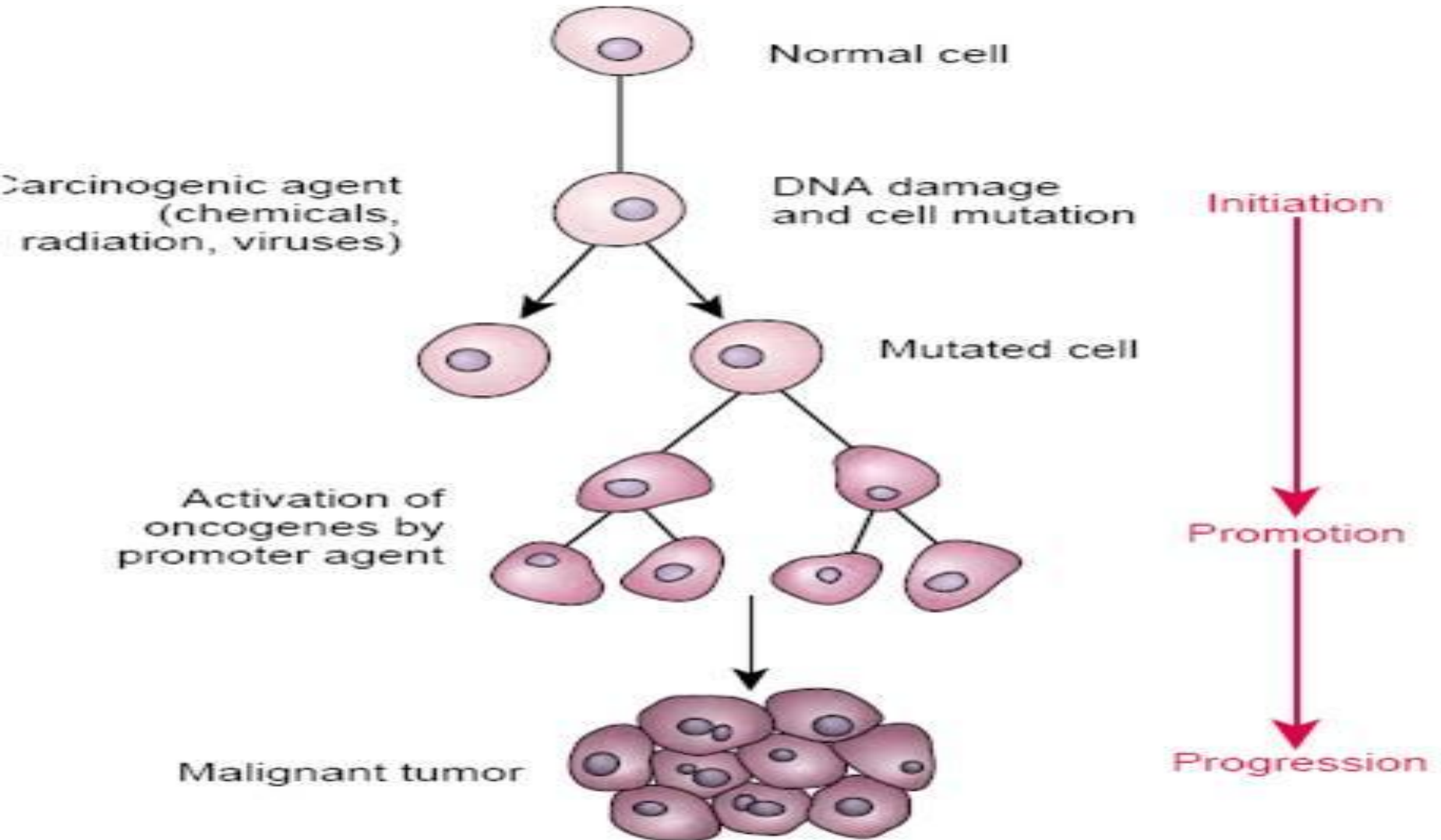
- contact inhibition
- Cancer cells have lost all restraint. They pile on top of one another and grow in multiple layers, forming a tumour.

5) Disregard of Growth Factors

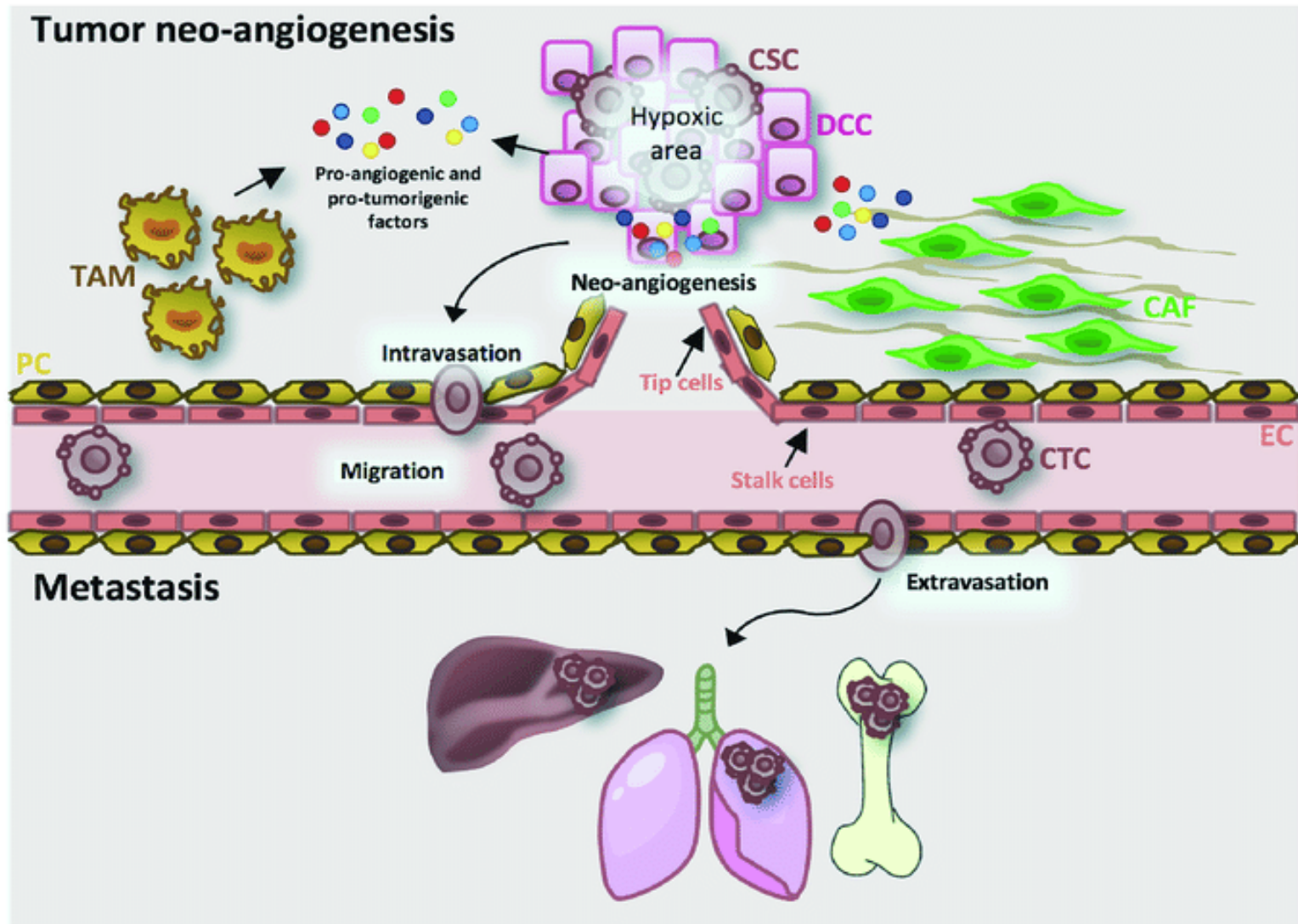
- Growth factors are chemical signals between cells that tell them whether or not they should be dividing.
- stimulatory growth factors and inhibitory growth factors.



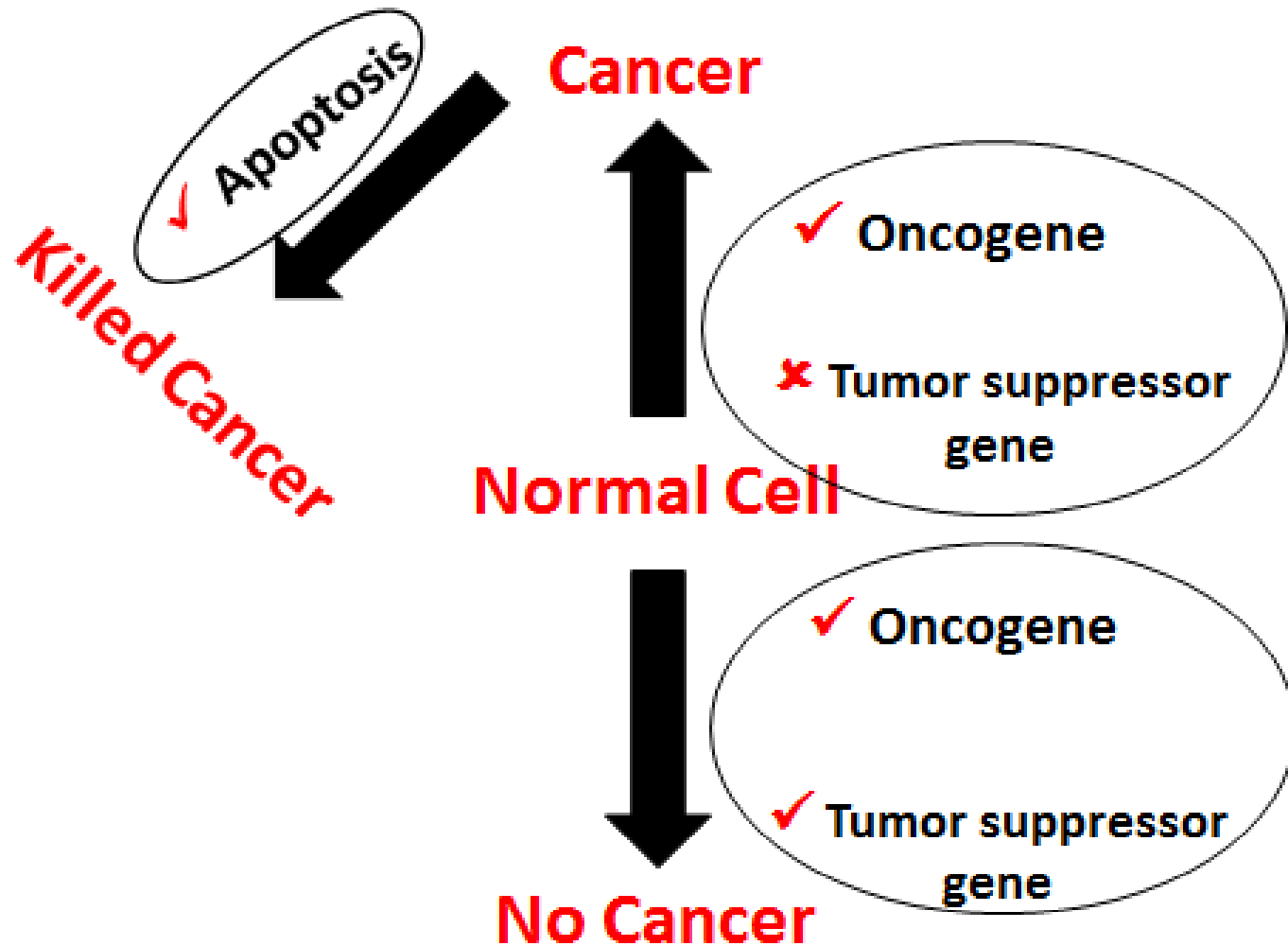
6) Cancer Cells Gradually Become Abnormal



7) Angiogenesis and Metastasis



Correlation between Gene Mutation & Cancer Development



Mutation of Proto-Oncogenes

“gain-of function,” or dominant

Cyclin D is a proto-oncogene that codes for cyclin directly. When this gene becomes an oncogene, cyclin is readily available all the time.

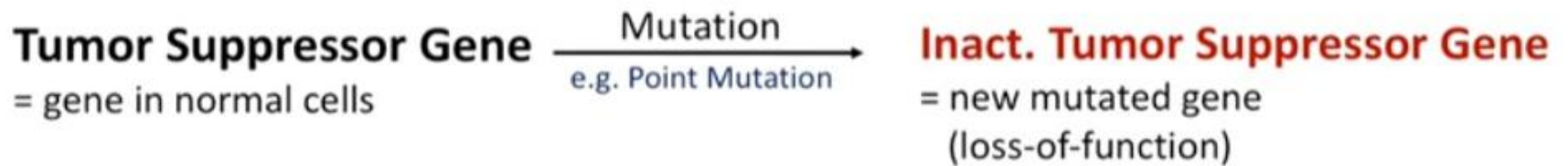
Oncogenes



Mutation of Tumor Suppressor Genes

- “loss-of-function,” or recessive

Tumor Suppressor Genes



Function:

slowing down cell division,
DNA repair machinery

-> promotes cancer

p53, activates DNA repair enzymes. At the same time, p53 turns on genes that stop the cell cycle from proceeding.

p53 – “Guardian of the genome”



Cell is no longer able to produce p53

- > **no** DNA repair, **no** apoptosis of damaged cells and **no** cell cycle arrest
- > p53 mutation in 50% of human cancers

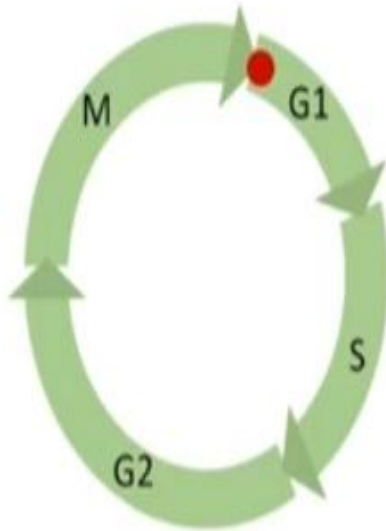
- The **BRCA1** gene codes for another DNA repair enzyme, it works very closely with the p53 protein. BRCA1 mutations prevent the body from recognizing DNA damage, allowing the cells to progress through the cell cycle unchecked. BRCA1 mutations are associated with a number of cancers, including breast cancer.

Oncogenes

At first Proto Oncogenes
(promote cell cycle)

Gain-of-function mutation

Acceleration of the cell cycle



Tumor Suppressor Genes

At first genes that slow down cell cycle

Loss-of-function mutation

no repair DNA, no initiation of apoptosis,
no cell cycle arrest

-> uncontrolled cell proliferation

