

S15635 Cancer
Warriors:
Unleashing the
Power of the
Immune System
Against Cancer

Week 3: Intro to Cancer

Jacob Kassama

The weekly plan:

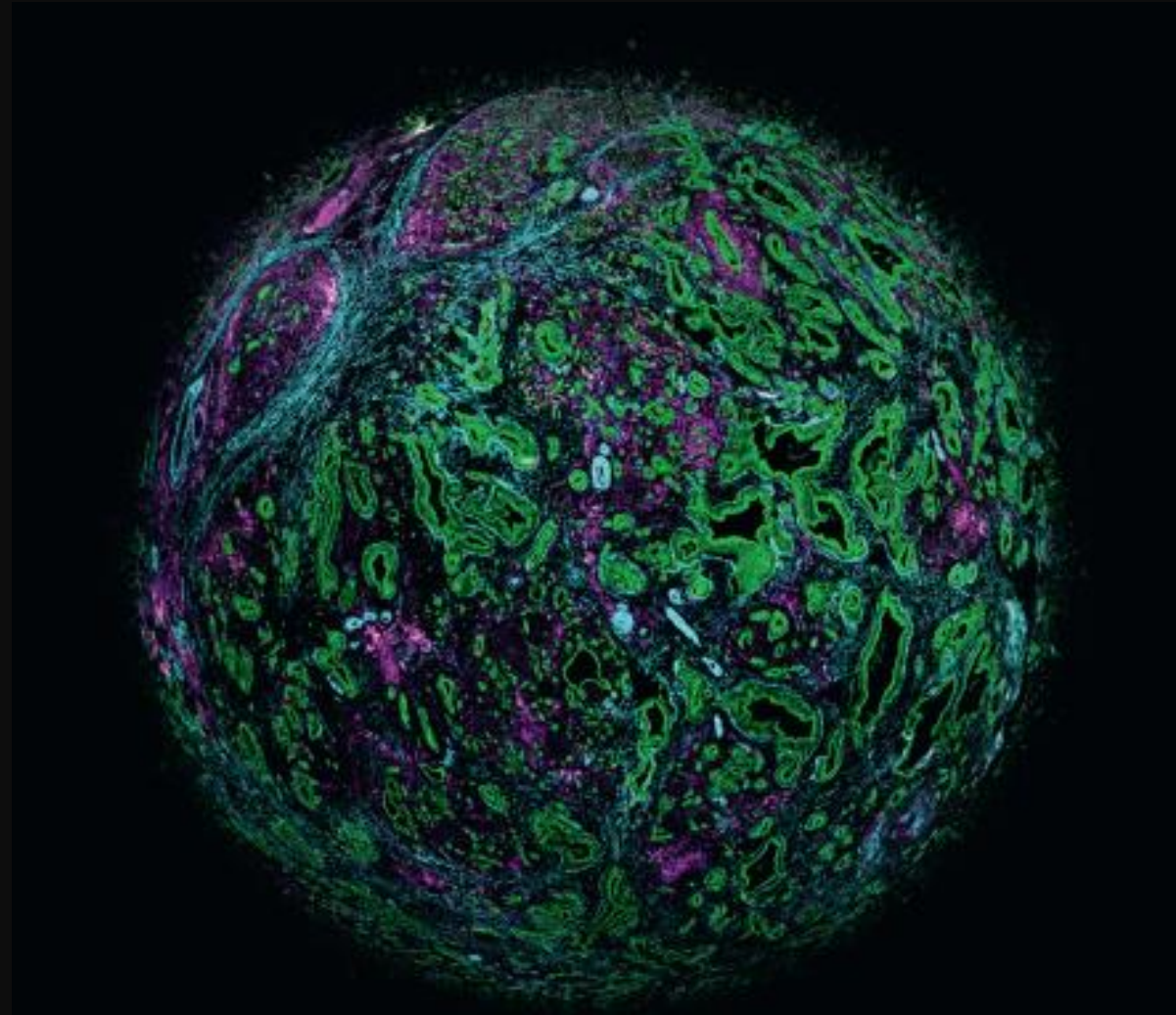
Week	Topic
1	Intro to the Immune System Part 1 <ul style="list-style-type: none">• Antigen Presentation• Dendritic Cells
2	Intro to the Immune System Part 2 <ul style="list-style-type: none">• T cell Immunity• Dendritic Cells Part 2
3	What is Cancer <ul style="list-style-type: none">• Defining Cancer• Tumor Mutation• Epigenetics• Tumor Architecture
4	Cancer Immunity Cycle Part 1 <ul style="list-style-type: none">• Immune recognition of cancer• Immune response of cancer
5	Cancer Immunity Cycle Part 2 <ul style="list-style-type: none">• Tumor immune evasion
6	Cancer Immunotherapies

What are your first thoughts when you hear cancer?

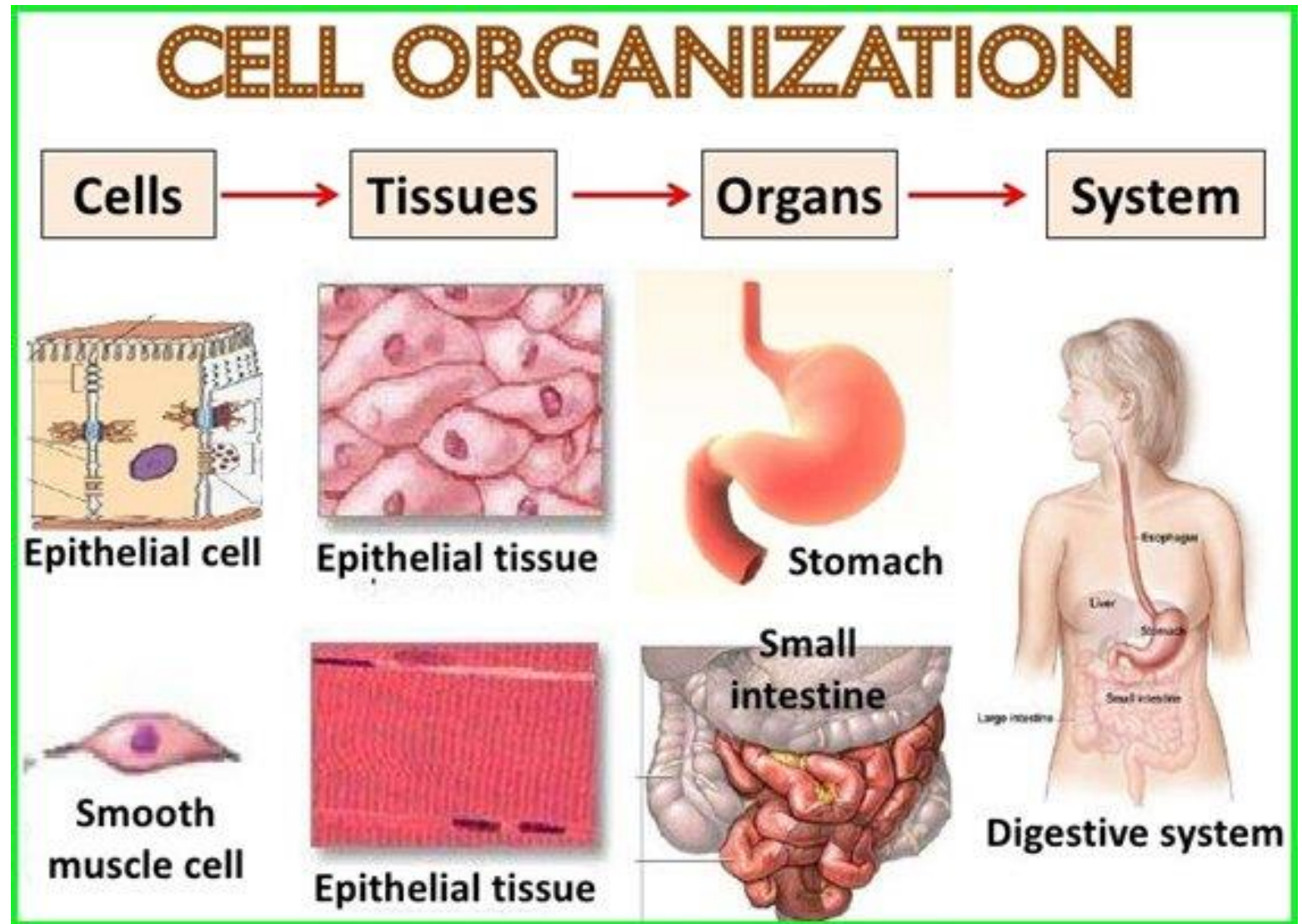
What is cancer?

Cancer is “a malignant tumor of potentially unlimited growth that expands locally by invasion and systemically by metastasis”

-Merriam Webster Dictionary

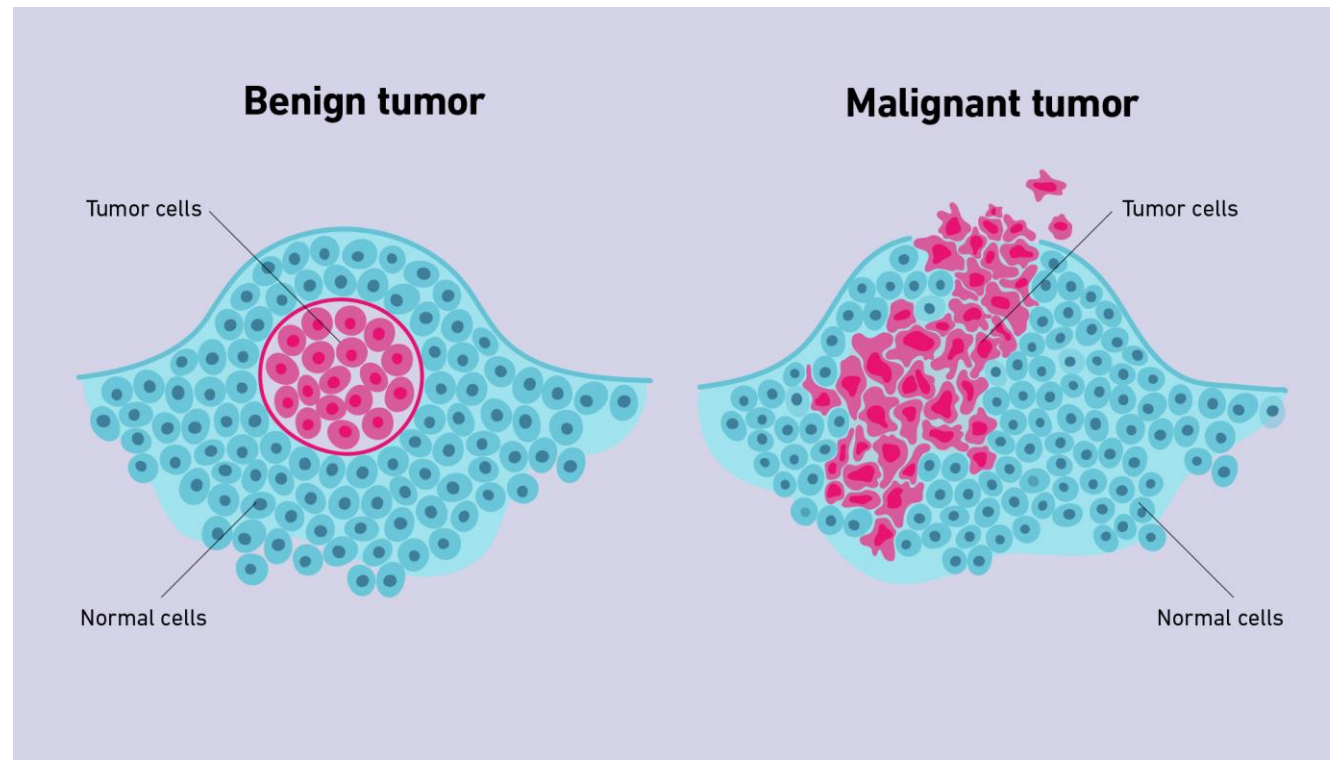


Organization of the body

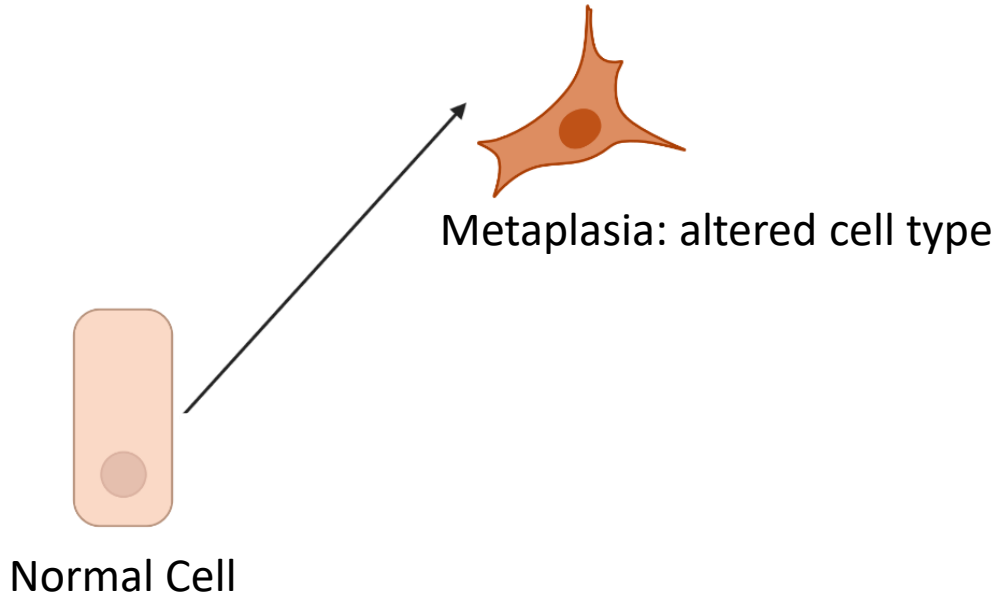


Malignant vs Benign Tumors

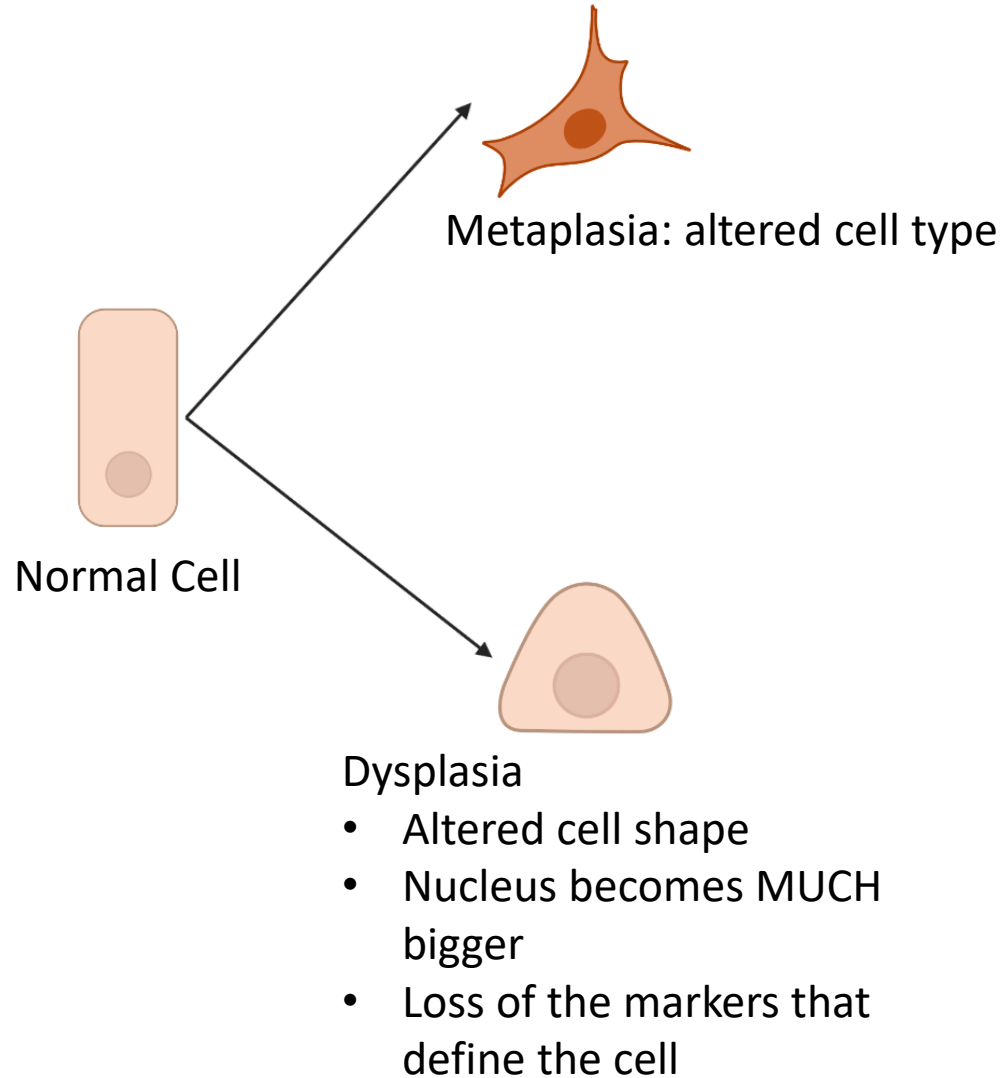
- **Benign Tumor** (non-cancerous): The local outgrowth of normal cells (these cells still have normal physiology)
 - Largely (not-always) lethal
- **Malignant Tumors** (cancerous): the growth non-normal cells (no longer retain their normal physiology)
 - Has the potential to spread to other parts of the body



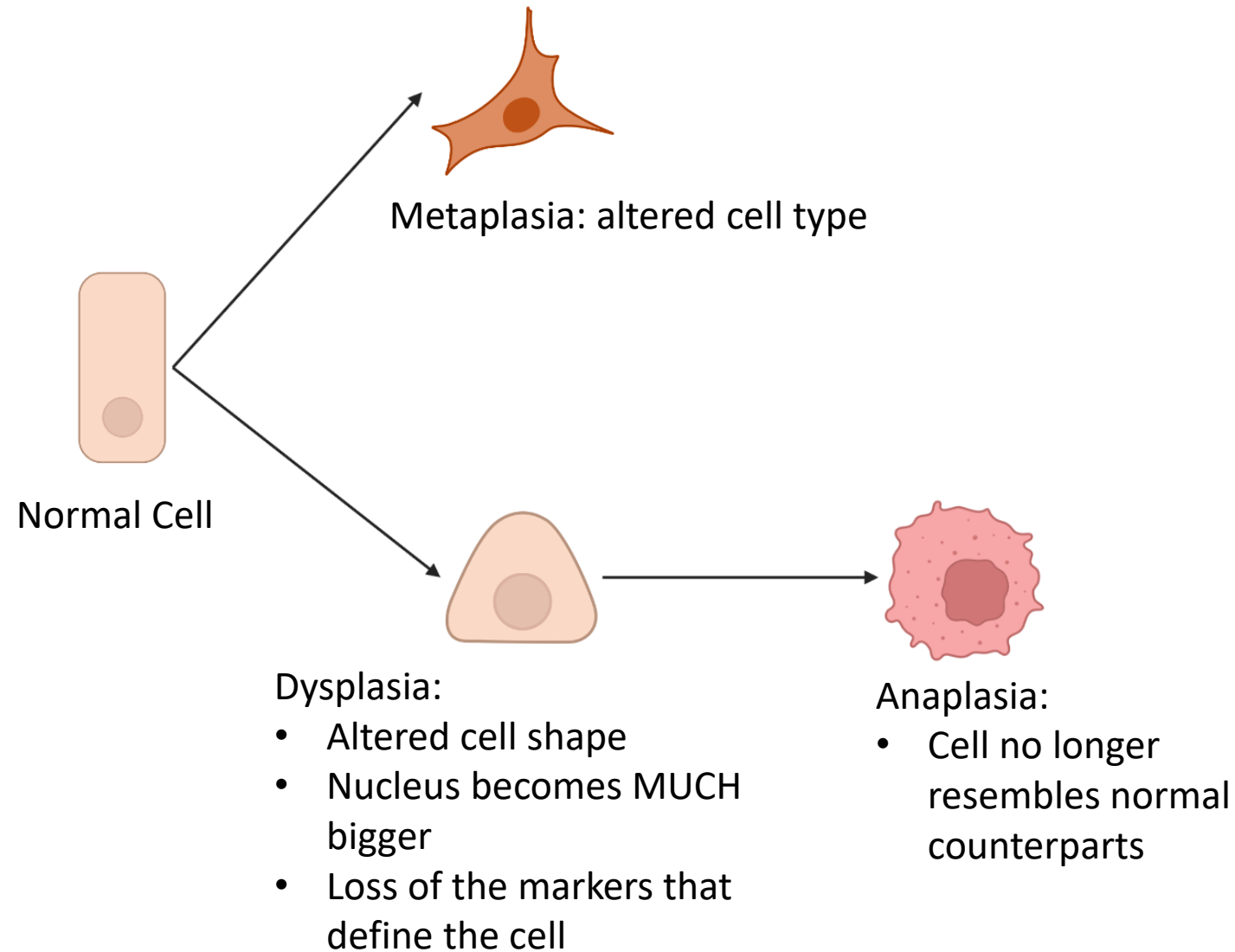
Cancer is a progressive disease



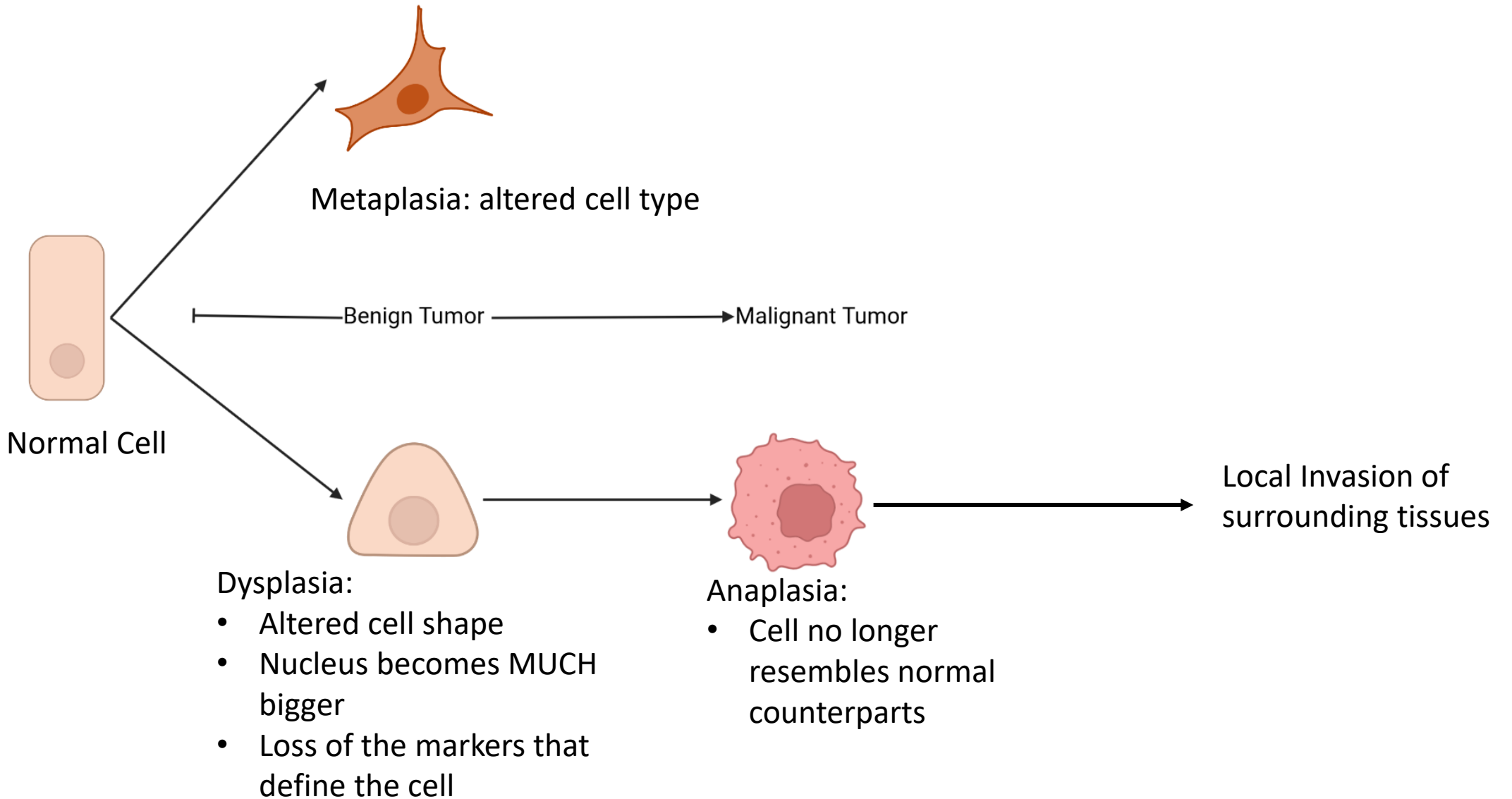
Cancer is a progressive disease



Cancer is a progressive disease



Cancer is a progressive disease



What do all of you think is the driver of cancer?

Causes of cancer:

- Genetic Factors
 - e.g., mutations in cancer associated genes
 - Epigenetic Factors
 - Infectious Agents
 - e.g., Human papillomavirus (HPV)
-

nature genetics



Central Dogma is a crucial tenet of biology

Question: What is the central dogma?

Central Dogma is a crucial tenet of biology

DNA



Transcription



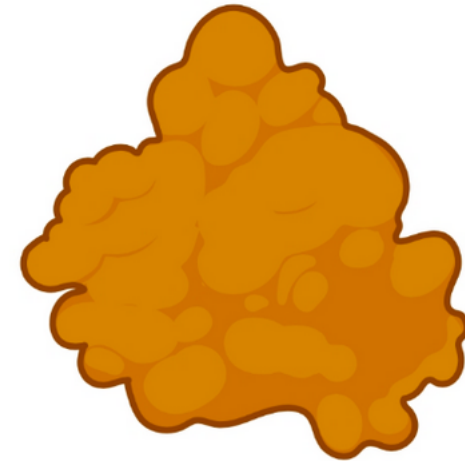
RNA



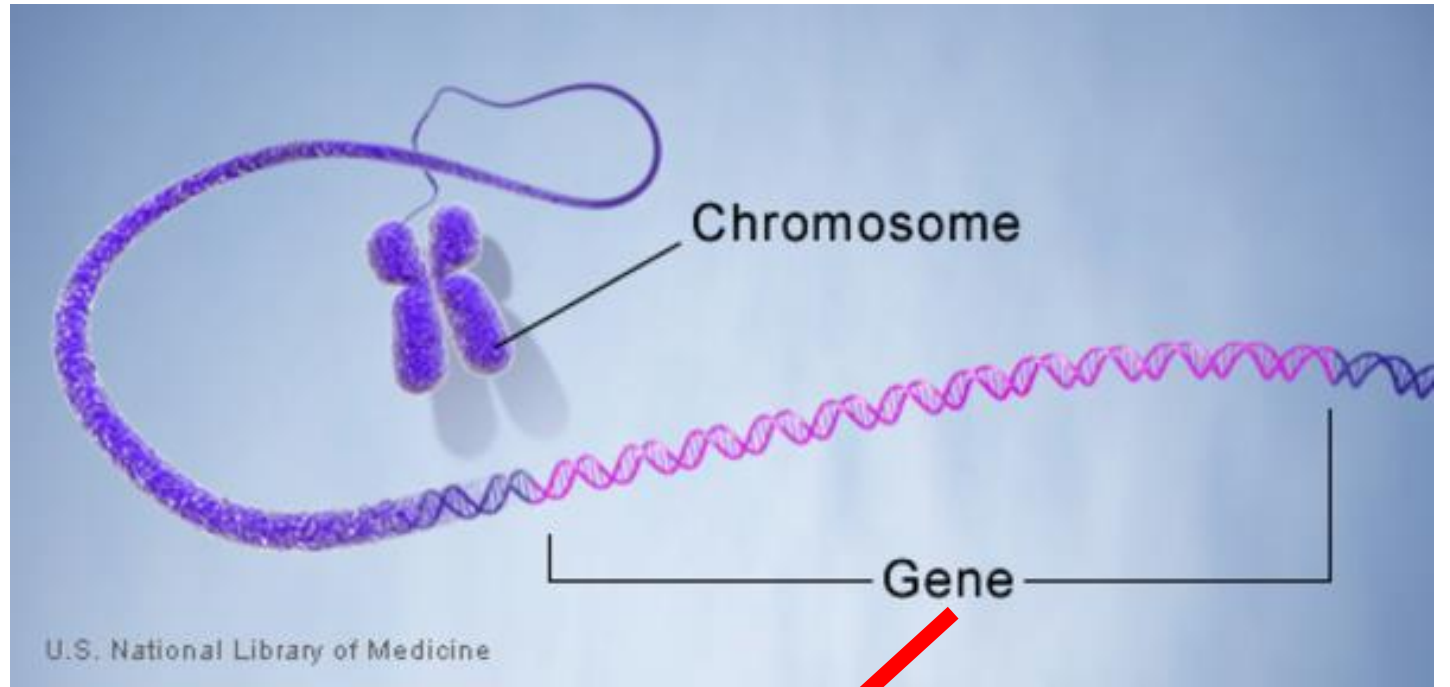
Translation



Protein



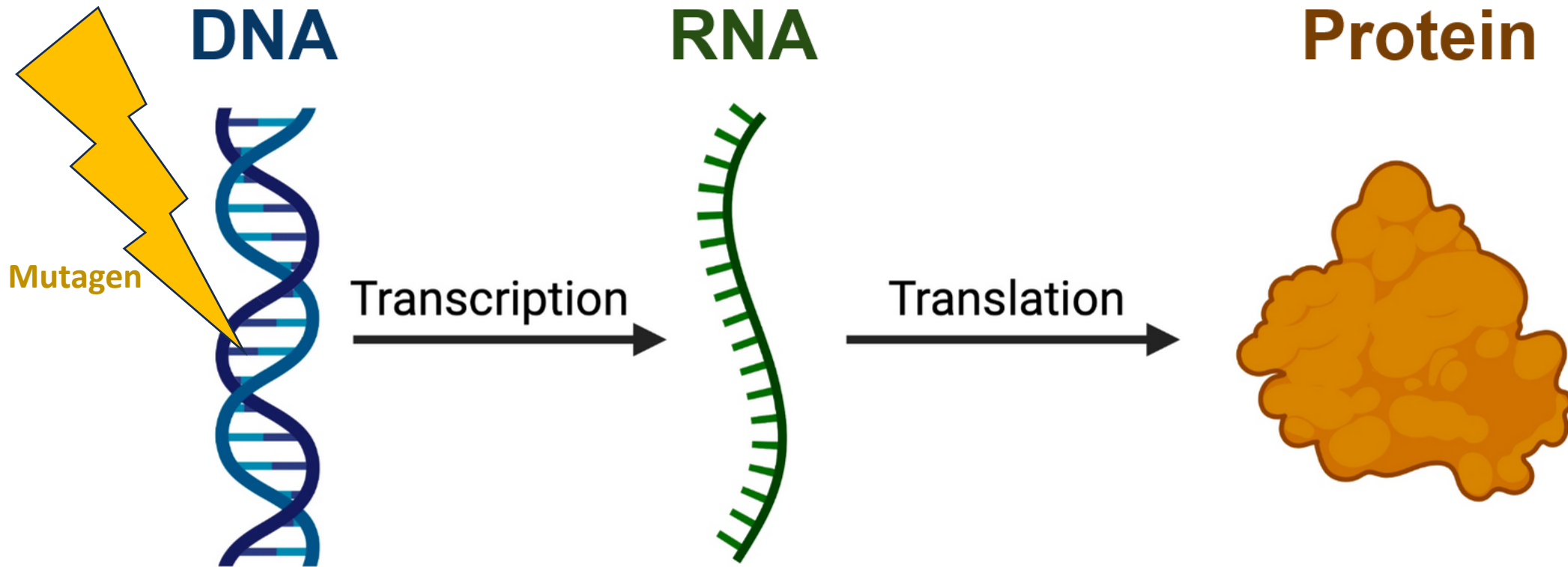
What is a
gene?



Protein

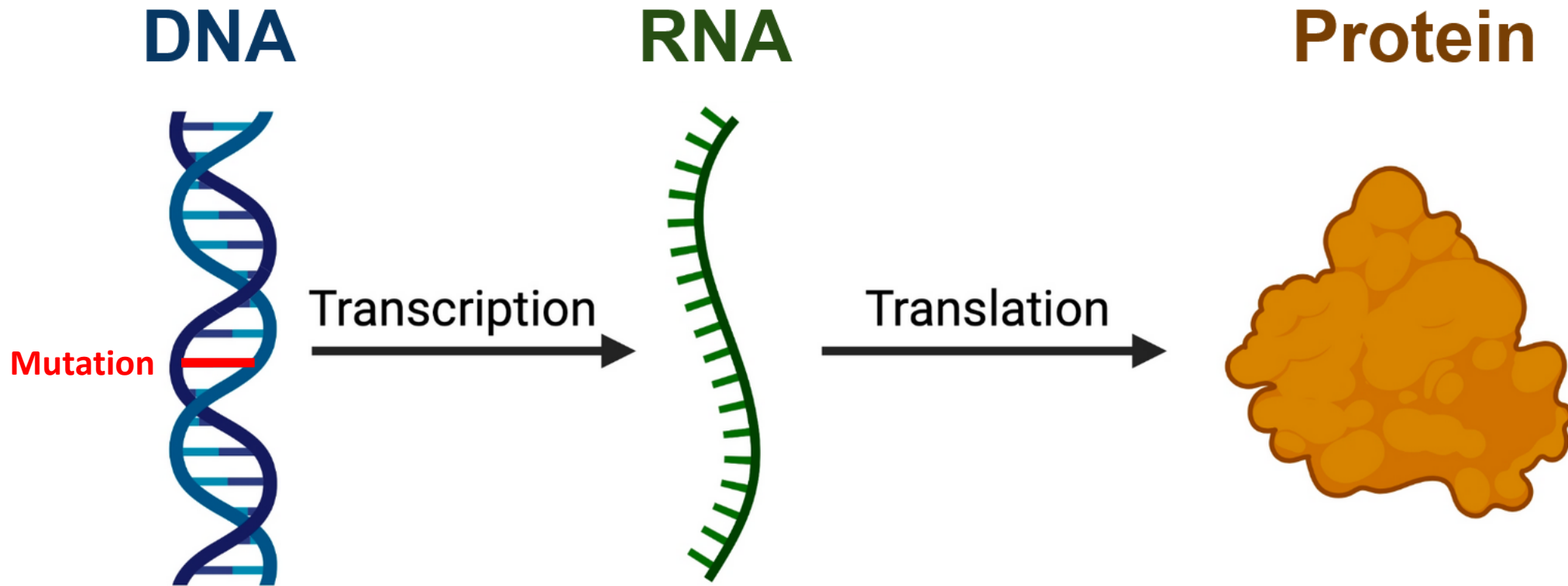


Central Dogma is a crucial tenet of biology

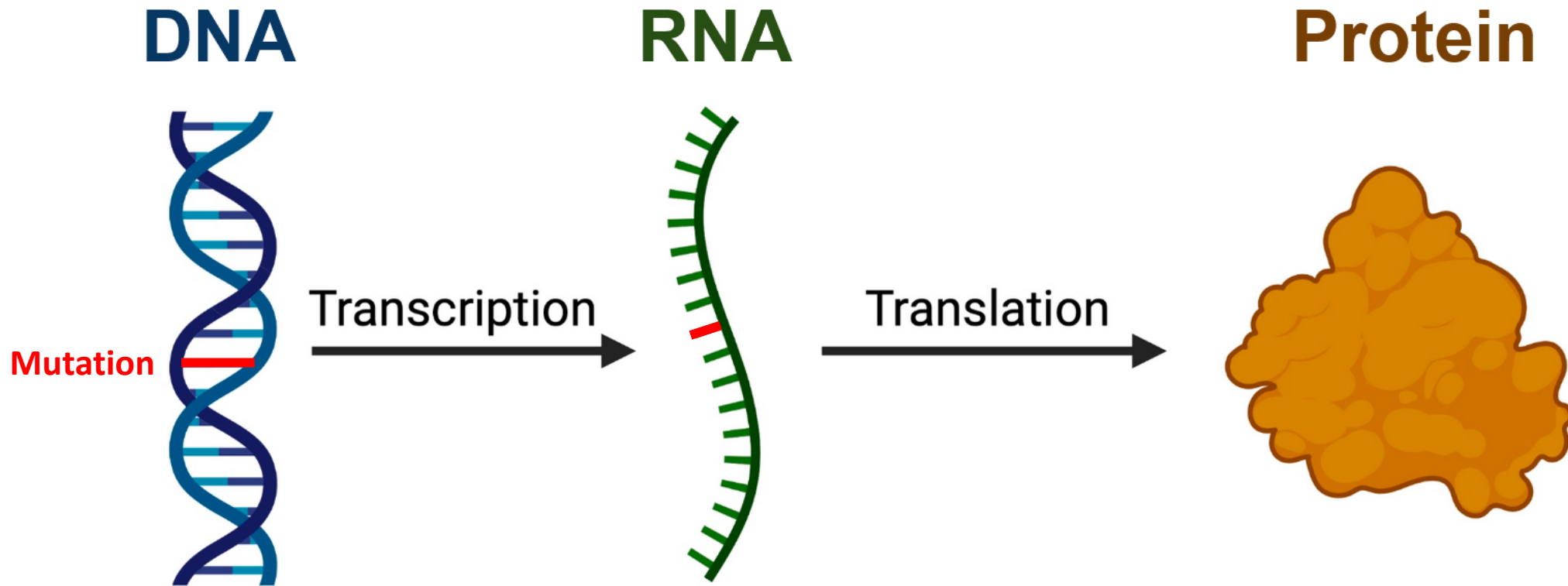


Question: What are some examples of mutagens?

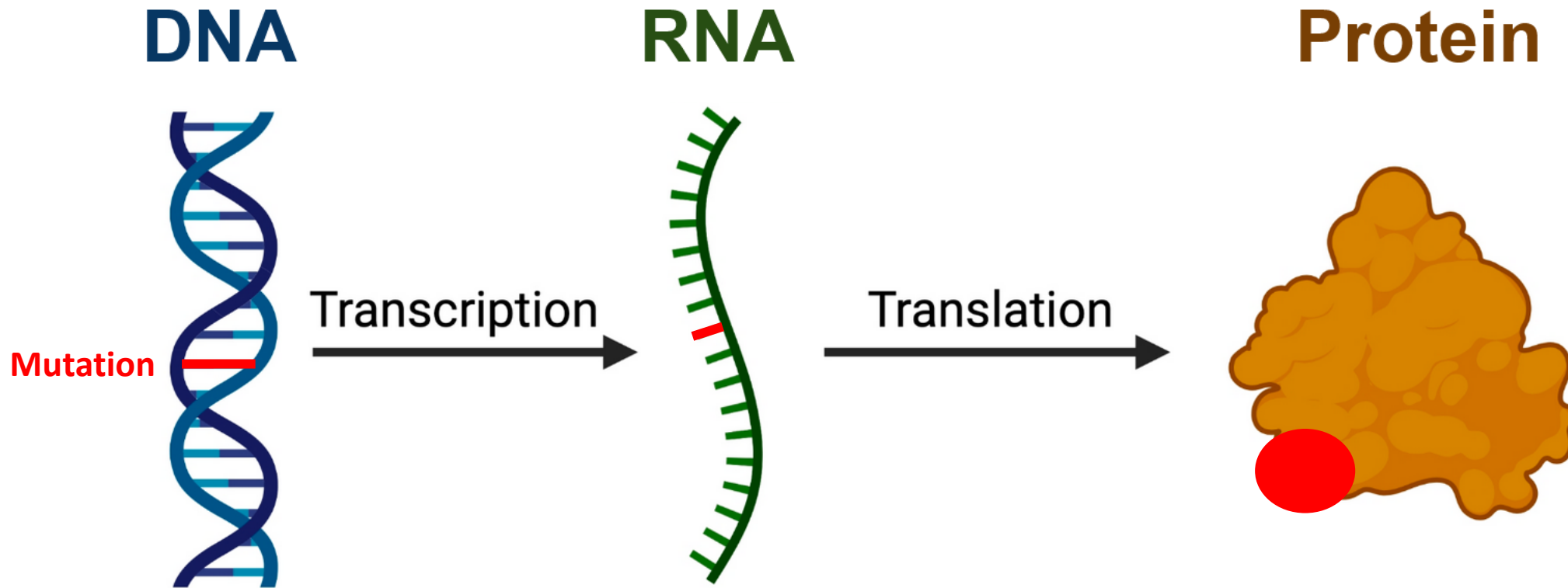
Central Dogma is a crucial tenet of biology



Central Dogma is a crucial tenet of biology



Central Dogma is a crucial tenet of biology



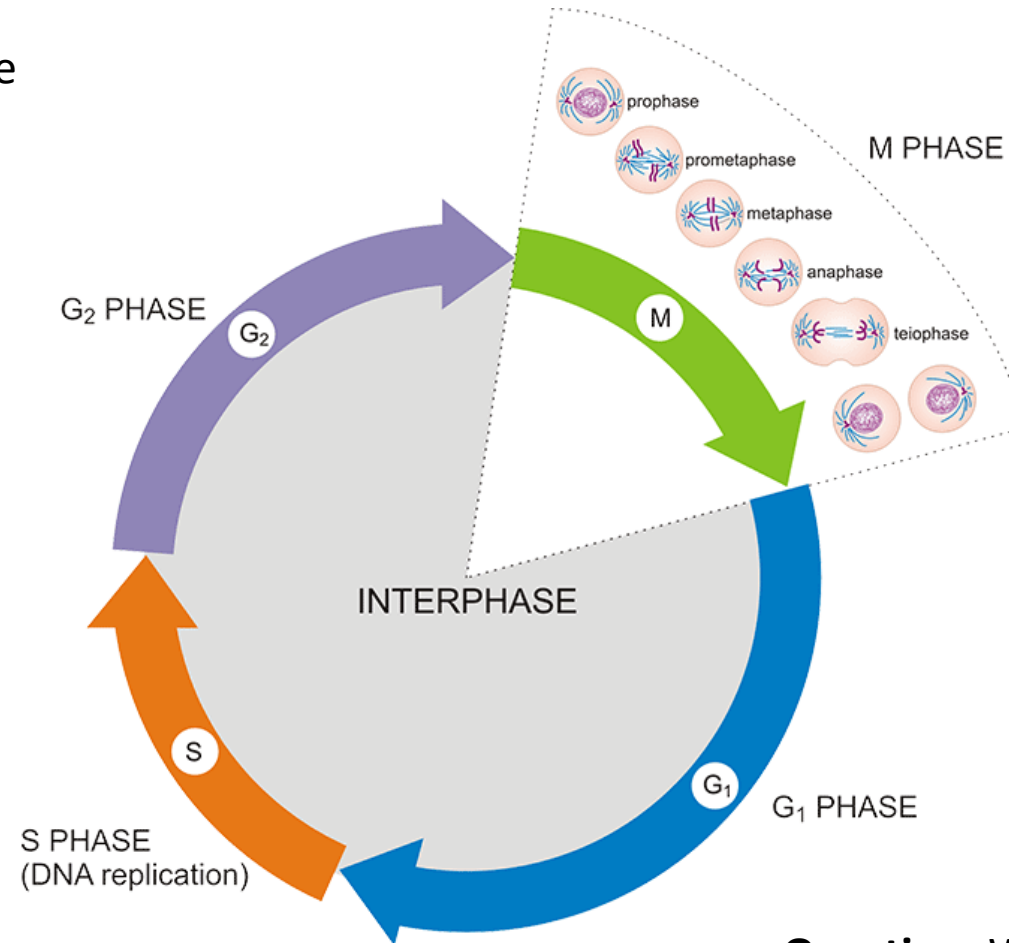
Question: What happens when a protein gets mutated?

- **Loss of function**
- **Gain of function**

Why do we care about these proteins having gain or loss of their functions?

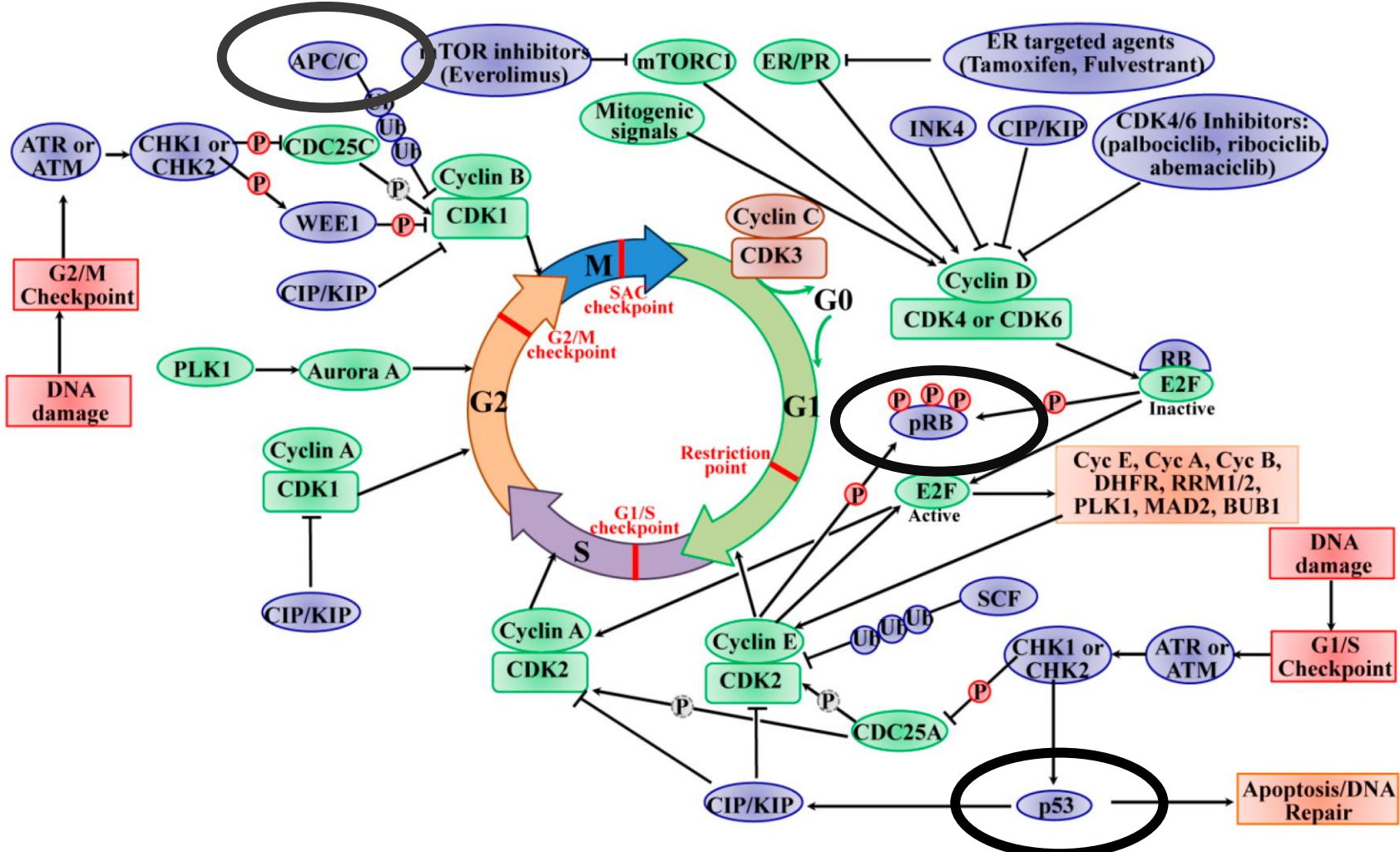
The cell cycle:

Remember: Cancer cells have uncontrolled growth



Question: What controls cell cycle?

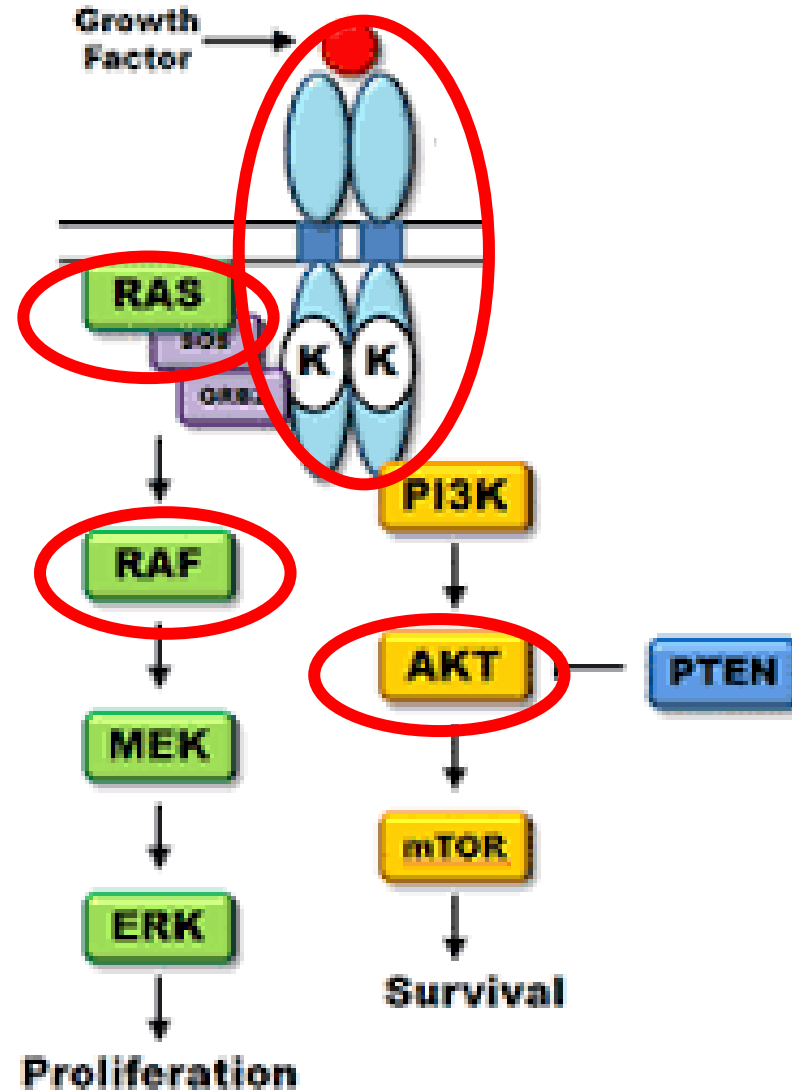
Proteins control the cell cycle!



- Tumor Suppressor Genes**
- “Cellular Gatekeepers”
 - Regularly prevent progression of cell cycle

Proteins control the cell cycle!

Cells signal with each other



There are signals inside of the body too!

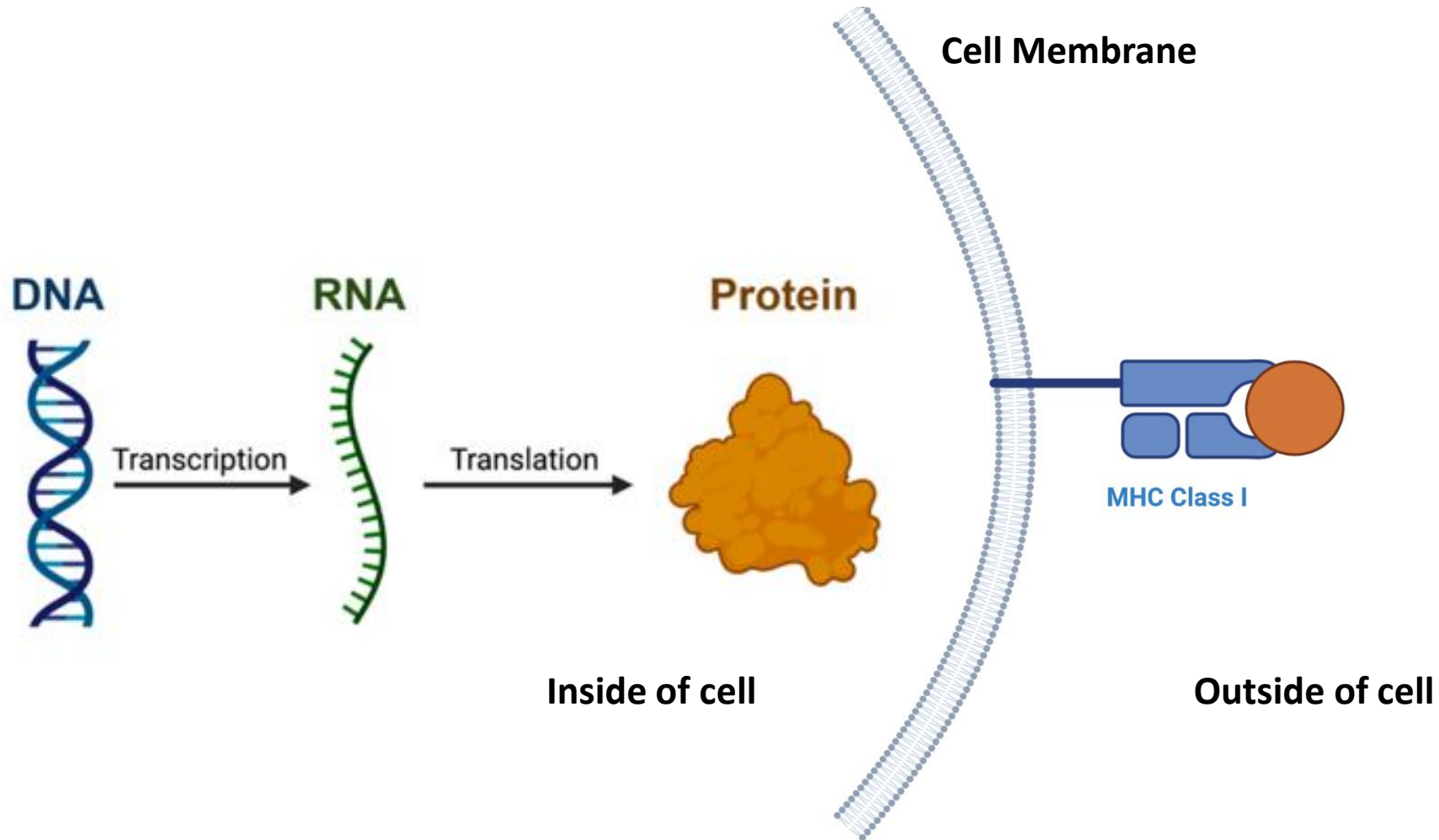
Oncogenes

- Regularly drives the cell cycle forward

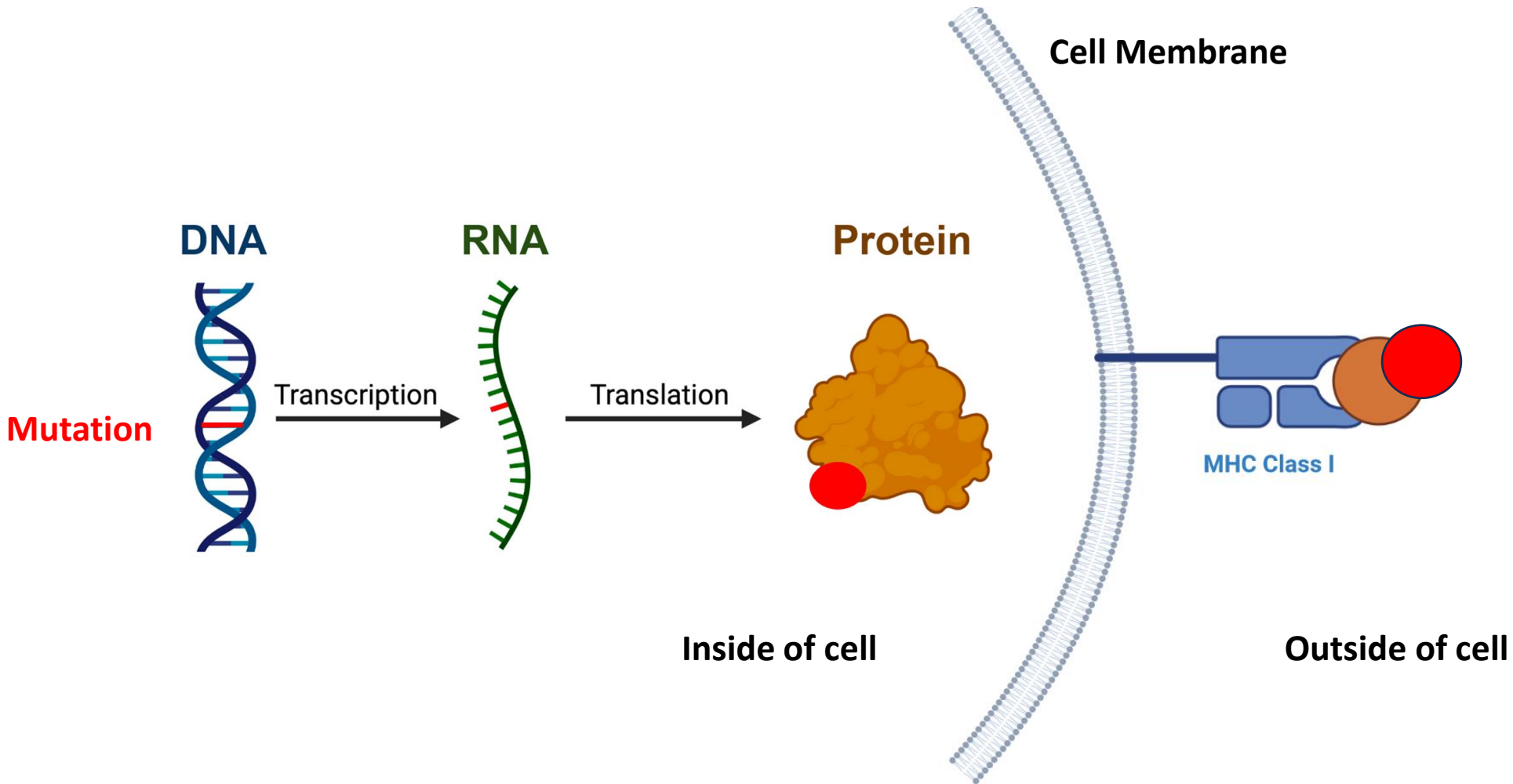
In cancers, what kind of mutations are associated with oncogenes?

Remember: What do all cells present on their cell surface?

All cells present bits of themselves on MHC-I!!!

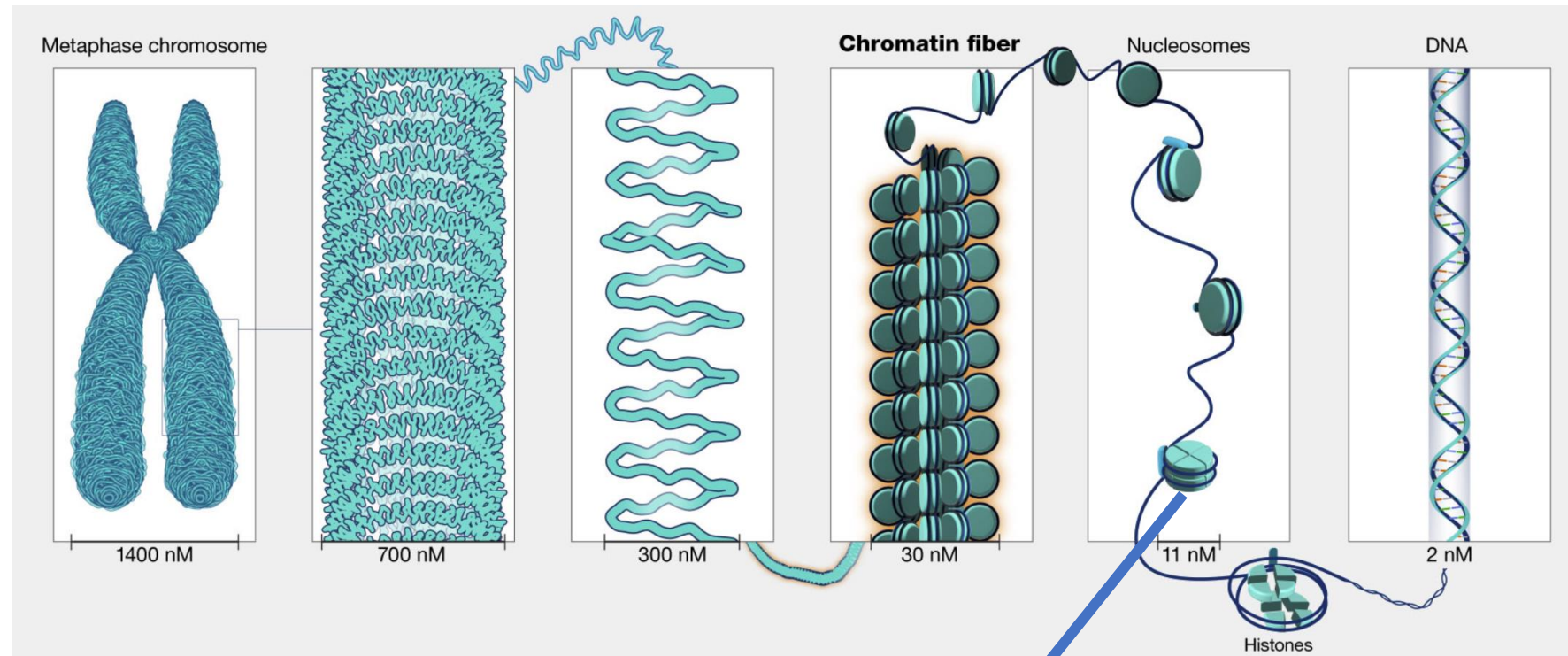


All cells present bits of themselves on MHC-I!!!



Some cells can regulate their gene/protein expression without mutating their DNA

Epigenetics: The study of how cells regulate their gene/protein expression without DNA alterations

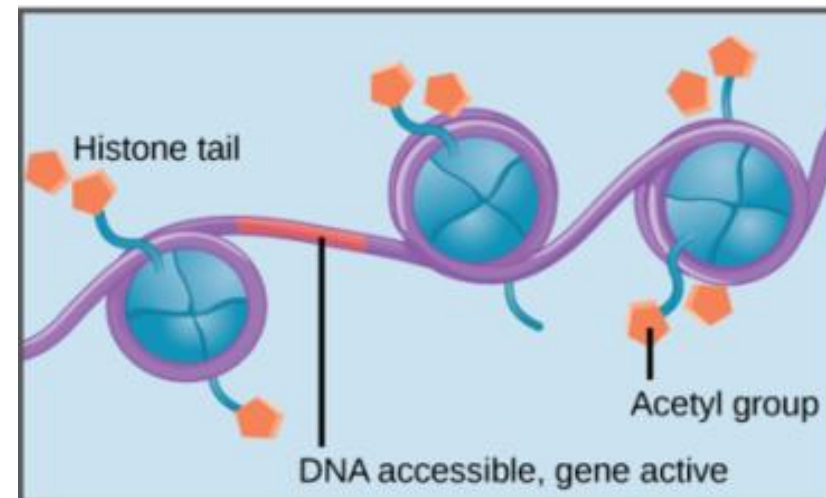
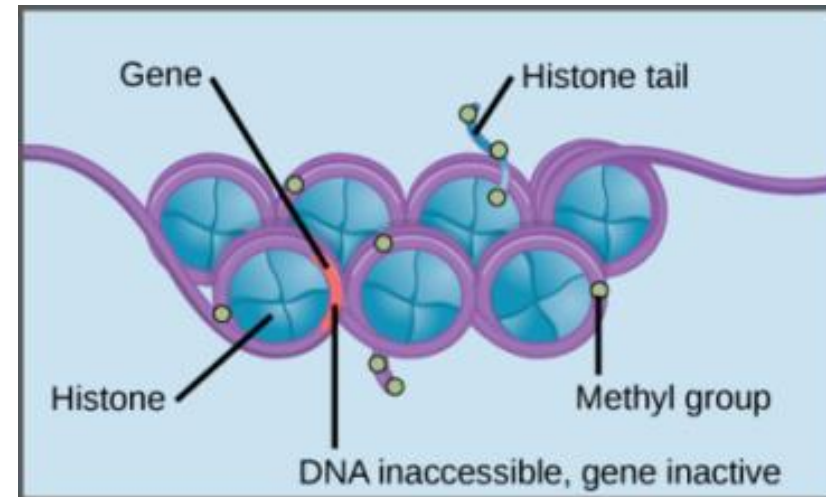


Median Length of a Gene: 24,000 base pairs

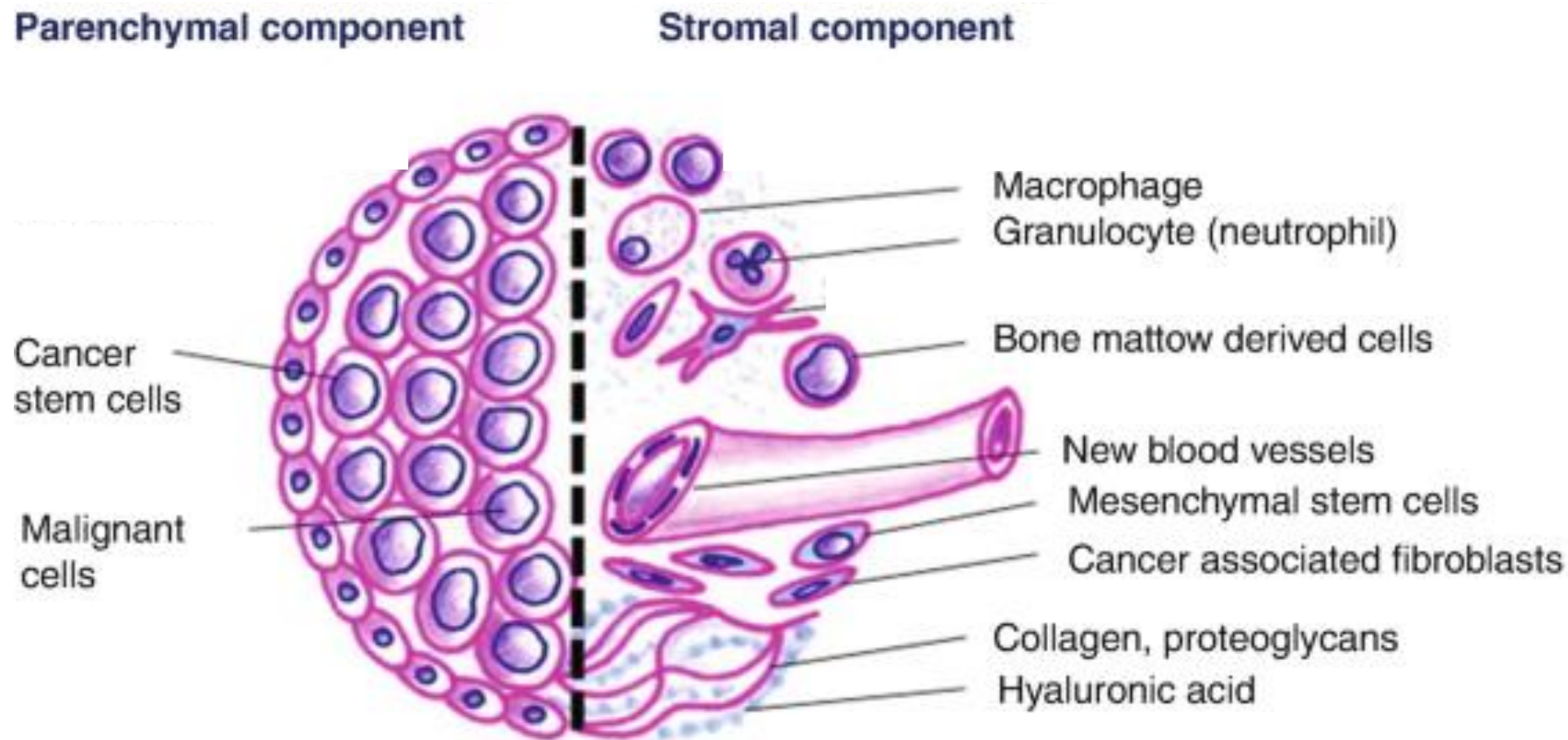
~150 Base Pairs

Some cells can regulate their gene/protein expression without mutating their DNA

Epigenetics: The study of how cells regulate their gene/protein expression without DNA alterations



Not all cells within a tumor are cancer cells!!!



Summary:

- Cancer is a progressive disease
 - i.e. there are different stages
- Mutations in DNA alter the function of proteins
- Cancer cells usually get started by getting mutations in tumor suppressor or oncogenes genes
- Altered functions of proteins encoded by tumor suppressor or oncogenes will lead to the loss of cell cycle control
- Not all cells within a tumor are cancer cells!

