# Difference Between Cancer Cell Cycle and Normal Cell Cycle

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## Key Difference - Cancer Cell Cycle vs Normal Cell Cycle

The cell cycle is the series of events that take place in the cell, leading to its division and duplication of DNA in order to produce new daughter cells. The cell cycle can be observed in both bacteria and eukaryotes. In bacteria, cell cycle consists of three phases (B, C, and D). "B" phase refers to the cell division, "C" phase is identified as DNA replication phase, and in the "D" phase, the cell is divided into two daughter cells. As in eukaryotes, the cell cycle is again divided into three phases. The interphase (G1, G2, and S), mitotic phase (M) and cytokinesis. During the interphase, the cell grows by accumulating the nutrients like protein and duplicates it's DNA. In the interphase, the cell is preparing for its division. During the mitotic phase, the chromosomes separate. In the cytokinesis, the chromosomes and cytoplasm separate into two new daughter cells. This is the normal cell cycle. In order to ensure proper division, the cell contains the mechanism known as cell checkpoints (G1 checkpoint, G2/M checkpoint, and Metaphase checkpoint). The check point's failures often cause mutations in which it generates a cancerous cell with the excessive division. **The key difference** between Cancer Cell Cycle and Normal Cell Cycle is that the **cancer cell cycle is containing cells of uncontrollable cell division, on the contrary, the cells in the normal cell cycle have controllable cell division.**

## What is Cancer Cell Cycle?

In a cell division, it is of utmost importance to have regulation in order to complete the proper cell division. The cell checkpoints are involved in this process in the cell cycle as they continuously regulate DNA damages, replication errors (**G1/S and G2/M checkpoints**) and correct spindle fiber attachment to the sister chromatids (**Metaphase checkpoint**). If the damage is unfixable, the cell undergoes programmed cell death or apoptosis.

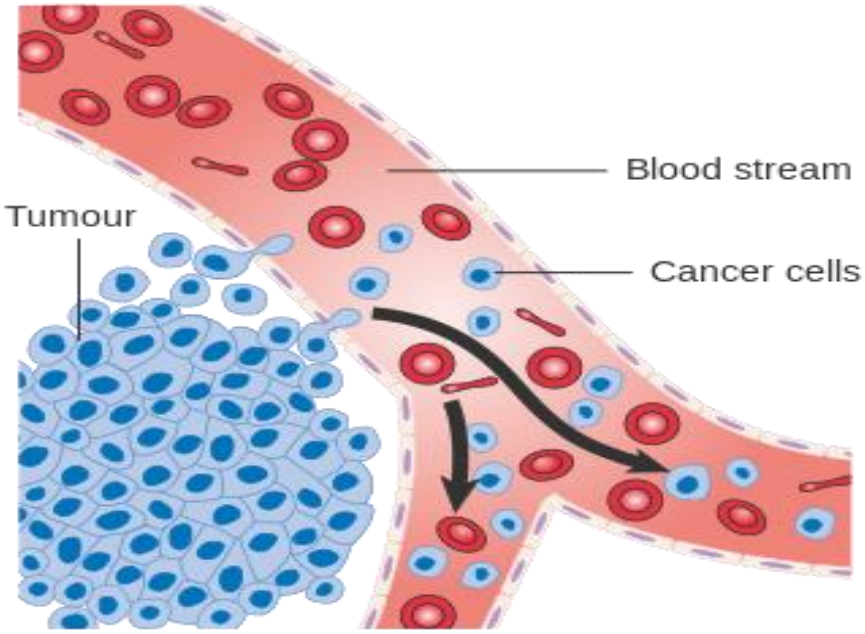


**Figure 01: Cancer Growth**

The cell checkpoints failures are causing the mutations to be activated and hence change the normal phase of cell division. This is known as **cancer cell cycle**. A famous example is that the Tp53 proto-oncogene and tumor suppressor gene that arrest cell cycle at the G1 checkpoint if it is detected any DNA damages. But the DNA mutation turns this particular **proto-oncogene** into **oncogene** where it won't arrest cell cycle though it detects DNA damages. This event causes further mutation in other genes related to the cell signaling receptors (cell receptors) like "Ras" and "tyrosine kinase." Ultimately it overexpresses the cell signal receptors and cell signaling and hence causes excessive cell division. Most of the time, the breast cancers, colon cancers and lung cancers are caused due to aforementioned disease trajectory. In a cancer cell cycle number of mutation might occur before observing the cancer malignant tumor.

# What is Normal Cell Cycle?

In eukaryotes, the normal cell cycle is divided into three phases. The **interphase (again divided into three stages: G1, G2, and S)**, **mitotic phase (M)** and **cytokinesis**. During the interphase, the cell grows, accumulating the nutrients like protein and duplicates it's DNA. In the interphase, the cell is preparing for its division. "G1" (Gap 1) stage of the interphase is contributed to the protein synthesis. While in the "S" (Synthesis) stage DNA is duplicated. "G2" stage is constituted of further cell growth by multiplying cell organelles. During the mitotic phase, the chromosomes separate. And finally, in the cytokinesis phase, the chromosomes and cytoplasm separate into two new daughter cells where it completes one cell cycle.

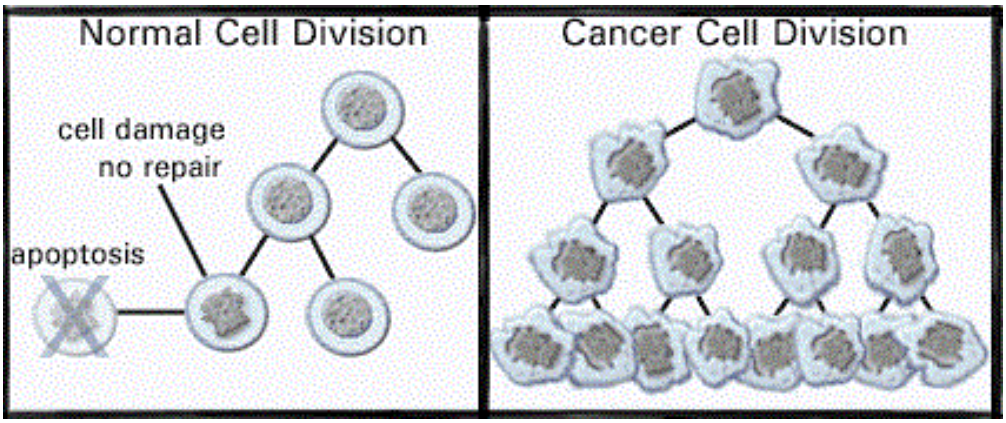


**Figure 02: Normal Cell Division and Cancer Cell Division**

In order to ensure proper division, the cell contains the mechanism known as cell checkpoints as mentioned below.

- G1/S checkpoint- regulates and fixes the DNA damages and replication errors.
- G2/M checkpoint- regulates DNA integrity and fixes the DNA damages.
- Metaphase checkpoint- examines whether all sister chromatids correctly attach to the spindle microtubules.

So, the checkpoints are extremely important. And the failures often cause mutation where it generates a cancerous cell with the excessive division.

## What are the Similarities Between Cancer Cell Cycle and Normal Cell Cycle?

- Cell division takes place in both the processes.
- Cells multiply in both processes.
- Growth phenomena can be observed in both cancer cell cycle and normal cell cycle.

## What is the Difference Between Cancer Cell Cycle and Normal Cell Cycle?

| Cancer Cell Cycle vs Normal Cell Cycle | |
|---|---|
| Cancer cell cycle is a cell cycle in which cells divide uncontrollably. | Normal cell cycle is a cell cycle in which cell division is controlled. |
| **Cell Communication** | |
| The cells do not communicate with other cells during the cancer cell cycle. | The cells communicate with neighboring cells and do response in |

| | |
|---|---|
| | the normal cell cycle. |
| **Checkpoints** | |
| Checkpoints are impaired, and check point's proteins are mutated in the cancer cell cycle. | Checkpoints do regulate the normal cell cycle in a correct way. |
| **Cell Repair and Cell Death** | |
| Cells are not repaired, and they do not undergo apoptosis during the cancer cell cycle. | Either cell repaired or undergoes cell apoptosis during the normal cell cycle. |
| **Maturation (Differentiation)** | |
| The cells in the cancer cell cycle are immature (undifferentiated). | The cells are matured in the normal cell cycle. |
| **Stickiness** | |
| The cancer cells do not have stickiness and hence float away. | The cells in the normal cell cycle contain stickiness and do stick together. |
| **Impact on the Immune System** | |
| The cells in the cancer cell cycle are evading the immune system. | The cells in the normal cell cycle when get damaged they are removed by the immune system. |
| **Angiogenesis** | |
| The cells in the cancer cell cycle undergo angiogenesis even when growth is not necessary. | The cells in the normal cell cycle undergo angiogenesis only as a part of normal growth. |
| **Ability to Metastasize (Spread)** | |
| The cells in the cancer cell cycle metastasize. | The normal cells are retained in the same place. |

# Summary - Cancer Cell Cycle vs Normal Cell Cycle

The cell cycle is the series of event that takes place in the cell, leading to its division and duplication of DNA in order to produce new daughter cells. The cell cycle can be observed in both bacteria and eukaryotes. Due to continuous mutations, the cell cycle loses its grip to control normal cell division. Hence it occurs the cancerous cells and cancer development. The key difference between Cancer Cell Cycle and Normal Cell Cycle is that the cancer cell cycle is containing cells of uncontrollable cell division, in contrast, the cells in the normal cell cycle have controllable cell division.

**Reference:**

1.Lynne Eldridge, MD | Reviewed by Grant Hughes, MD. “Cancer Cells vs. Normal Cells: How Are They Different?”. Available here
2.“Cell cycle checkpoints.” Khan Academy. Available here

**Image Courtesy:**

1.'Diagram showing cancer cells spreading into the blood stream CRUK 448' By Cancer Research UK uploader - Own work, (CC BY-SA 4.0) via Commons Wikimedia
2.'Cell 2'By Janyna Calderón - Own work, (CC BY-SA 4.0) via Commons Wikimedia

**How to Cite this Article?**

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