

X-men: Wolverine

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Abstract

This paper looks at the character Wolverine from the X-Men series. We are focusing on his rapid ability to regenerate his body cells, allowing for full and fast recovery after injury.

Introduction

X-men is a popular comic series, later adapted into a series of films. It consists of a team of mutant superheroes in the Marvel Universe, recruited and trained by Professor Xavier. These young mutants are trained to gain better control of their superhuman powers, and to use it for the benefit of humanity, proving that mutants can be heroes.

Wolverine

Wolverine's primary mutation is in an increased healing process which allows him to regenerate his damaged cells or tissues in a short period of time. Although his regeneration capabilities are heightened, this ability does not prevent suppression of any pain endured.

His accelerated healing abilities also provide him with the immunity to foreign chemicals and diseases. Adamantium also plays an important role in the rate of Wolverine's healing because it produces a poison which his body is constantly fighting off. Without adamantium, his healing powers increase. However, the healing powers of Wolverine forces his mind to suppress memories, and can even result in amnesia.

Cellular Division

The division of cells results in genetically identical daughter cells, excluding gametes (sex cells). A typical human cell has approximately 2 metres of DNA, which must be fully replicated during cell division. This is done by the packaging of an individual's genetic information, or genome, into chromosomes for easy management. All bodily (somatic) cells contain 23 sets of chromosomes in each cellular nucleus, whereas reproductive cells

(gametes) have half the number of chromosomes of somatic cells [1].

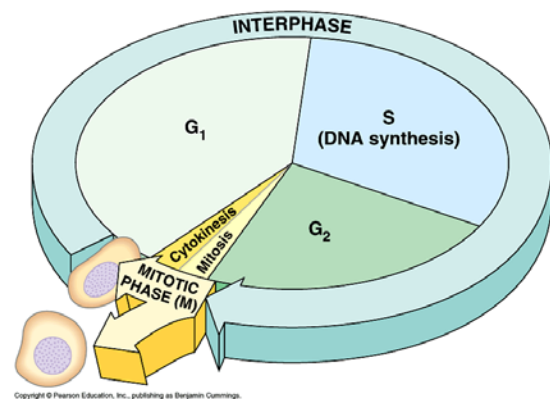


Figure 1 The cell cycle [1]

Phase M of the cell cycle involves mitosis (division of the nucleus) and cytokinesis (division of the cytoplasm). This phase alternates with interphase: a growth period, which can be further divided into the G₁ phase ("first gap"), the S phase ("synthesis") and G₂ phase ("second gap") [2]. DNA replication takes place in the S phase. Mitosis can be further broken down into 5 stages: prophase, prometaphase, metaphase, anaphase, and telophase. The daughter cells produced can then go on to repeat the cycle [1].

Phase M would last approximately an hour, whereas the phase S would occupy between 10 and 12 hours. The rest of the time would be divided between the two G phases: G₂ usually occupies 4 – 6 hours and G₁ varies depending on the cell type. A cell can divide approximately once in 24 hours [1].

Telomeres are also important factors during cell division; they are sections of repeated DNA

sequences at the end of a eukaryotic chromosome which protects the genes from being eroded during replication [1].

Stem Cells

Stem cells can be defined as unspecialised somatic cells with the potential to differentiate into more specific cells; in one cycle of cell division, a stem cell may produce one identical daughter cell, and another more specialised daughter cell that can further differentiate [1].

Cell Death

A cell has a limit on the number of times it is able to divide; this limit is known as the Hayflick limit, or the Hayflick phenomenon. Although, the number of cell divisions may not have an effect on the longevity of biological cells, and humans themselves, the type of cell dividing is of high interest in this case.

Apoptosis is the process of programmed cell death; it is controlled by signals that trigger the activation of several suicide proteins in the desired cell [1].

Through Hayflick's observations, he found that the length of telomeres associated with each cell's DNA will shorten with each division, and eventually reach a length that will not process the division of that cell [3]. The maximum number of times a cell can divide is approximately 40 – 60 times before undergoing cell death. Once a cell has reached its Hayflick limit, the process of apoptosis begins [4].

Cancerous cells have mechanisms that allow for uncontrolled cell growth; they bypass the signals inducing the process of apoptosis, allowing them to proliferate and increase in numbers. Cancer cells are

also more self-sufficient than normal cells with regards to their growth and proliferation [5]. They may have extra receptors on the cell surface, allowing for amplification of the signals for proliferation. Furthermore, the shortening of telomeres does not occur in cancerous cells due to an enzyme known as telomerase, which regenerates the telomere strands, and allows the cell to divide infinitely [7].

In Context/Conclusion

If stem cells with the ability to differentiate into any given cell were able to evade the Hayflick limit, like cancerous cells, they could thus divide an indefinite number of times. They could then continuously differentiate into several types of cells. The Hayflick limit could also be evaded if the length of the telomeres were to be retained after each division, thus resulting in an infinite number of divisions.

It can then be suggested that Wolverine may possess the enzyme telomerase, allowing his cells to divide indefinitely and consistently replace those which are lost. If the cell cycle process were also to be sped up, in a similar process to cancerous cells, the period of time taken for a cell to divide would be much shorter, allowing for faster cell division and thereby a faster healing process. Additionally, as humans age, cells may accumulate mutations over time and can become susceptible to DNA damage. With a faster rate of division, cells that may be damaged by external factors, such as UV radiation and chemical mutagens, are constantly being replaced by new cells. This could also be an explanation for his immunity to the foreign chemicals and diseases.

References

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