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Providing biological theories to explain Gollum's extension of life

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Abstract

Gollum is a hobbit that is featured in *The Lord of The Rings*, where his story is primarily focused on his possessive love of the One Ring. The power of the ring causes an unusual extension of life and in Gollum's case caused him to live to around 500 years old. However, how did the biology of Gollum change for him to be able to live this long? Explanations surrounding telomere length, protein translation and lifestyle are included in this article to try to explain this question.

Keywords: Book; Biology; Genetics; *The Lord of The Rings*; *The Hobbit*; Gollum

Introduction

Gollum, previously known as Sméagol, is a character from Middle Earth; a place found amongst the wonderful works of Tolkien featured in *The Lord of the Rings* [1] and *The Hobbit* [2]. The One Ring is an evil artifact that takes centre stage in these stories and was created to control all of those that inhabit Middle Earth. After encountering the ring, Gollum who was formerly a charming young hobbit, succumbed to its dark power turning him into a distorted and unrecognisable creature (see figure 1). The influence of the ring caused his body and soul to be forever bound to it, extending his lifespan to an exceptionally unnatural length [1, 2]. It is evident in the literature that the ring caused this extension of life but the question that remains unanswered is what alterations to Gollum's biology occurred that essentially made him become immortal. In this article, multiple theories regarding Gollum's lifestyle and cellular/genetic biology will be discussed to try to explain this unusual occurrence.

Species Biology

In the prologue of *The Lord of The Rings*, the origin of the hobbit species is unknown, but it is stated that they are most likely an offshoot of human descent [4]. Due to not knowing their biology, humans will be used to support these theories. However in this article, the use of two species studies, *C.elegans* (a type of worm) [5] and mice [6], have been included to explain the inhibition of a particular protein that

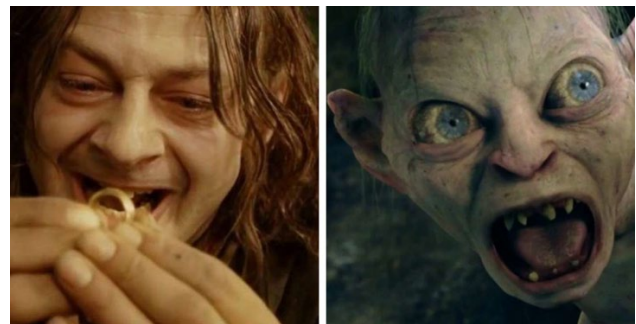


Figure 1 – An image showing when Sméagol first found the ring (left) and 500 years later (right); a distinctive comparison in his appearance is shown, clearly displaying the effect the ring had on him [3].

can increase lifespan. We do know that humans possess this protein but the results of inhibiting could be different to that of mice and *C.elegans*, as no clinical studies have been conducted on humans. One already known difference between humans and hobbits is their average life span. Modern humans have an average lifespan of 73.5 years [7] whereas, hobbits have an average of approximately 96.7 [8, 9]. Therefore, it is important to note, that these theories could be inaccurate because we are basing the foundations on human biology and not that of a hobbit.

Telomere Length

A telomere is a repeated DNA sequence that is found at the end of chromosomes. This region is there to protect the rest of the DNA during cell replication, however, every time a cell divides the length of the

telomere becomes shorter and shorter. This increases the risk of the DNA in the chromosome becoming damaged, resulting in a degradation of cell structure and function [10]. In 2007, a study was conducted to discover if a correlation between ageing and telomere length exists; the scientists concluded that from the ages of 60-99 there was a progressive decline of telomere length. Particularly, mean length of telomeres found in lymphocyte cells were reduced [11]. Lymphocytes are vital to the immune system as they fight diseases that enter into our bodies and prevent tumour formation [12]. The degradation of telomere lengths as we become older could cause our body's immune system to weaken because the essential DNA information of lymphocytes are exposed to a higher risk of mutations/deterioration. There is evidence of cancer cells being able to maintain their telomere length by upregulating telomerase, which is an enzyme that offers eternal replicative potential of cells by continuously synthesizing new base pairs onto the ends of telomeres [13]. Therefore, if the One Ring were able to sustain telomeric length, or extend it, via telomerase upregulation this would protect his cellular structure and function and thus lengthen his lifespan.

Protein Translation

During translation of proteins, a kinase called target of rapamycin (TOR) regulates cell growth, cell cycle progression and cell/organ/organismal organisation. By inhibiting this protein, along with other proteins (S6K), it leads to a decreased rate of translation which interestingly increases lifespan, as found in a study conducted in 2007 on a species of worm called *C.elegans*. This increase in lifespan in organisms could be explained by a stress response being triggered after the inhibition of translation, causing a prevention of damage that would normally accelerate ageing [5]. As well as this, in Wu et al., they found that mice that had loss of function in their mTOR alleles (decreasing the overall activity of TOR), had a survival duration which was 20% higher than those who did not [6]. Gollum could have this

mutation where the TOR kinase is inhibited and therefore decreases translation of proteins and results in an increase of lifespan.

Lifestyle

From living a quaint life as a hobbit to living in a dark/dingy cave and having to eat a pure protein diet of raw fish and orcs (a species found in the Lord of The Rings series), the ring had a huge influence on Gollum's lifestyle completely turning it upside down. However, this change in lifestyle could have altered Gollum's biology and therefore contributing to his extended lifespan. In the study of the *C.elegans*, they also discovered that a restriction of diet caused a stress response which then led to the inhibition of the TOR kinase, in turn increasing their lifespan [5]. As previously stated, Gollum's restriction of diet by only eating protein could have generated an inhibition of his TOR kinases. As well as this, once Gollum possessed the ring his one true desire was to have it always close to him, becoming infatuated by it. When he had the ring his stress levels would have been very low as his desires were fully fulfilled. There is evidence of stress having an impact on humans and also causing an increased rate of degradation to the body's telomeres [5], which Gollum would have been prevented from.

Conclusion

In conclusion, there are multiple biological theories that can explain Gollum's extension of life, but it is important to take into account that these theories are based on human biology and not the biology of a hobbit. As well as this, the scientific explanations provided may not have been proven to completely extend lifespan to 500 years, however, the magic of the One Ring is assumed to enhance the biological effects discussed in the sections above. Even though his biology would have changed to increase his lifespan, the influence and power that Gollum's Precious (the One Ring) had over him, could have subdued the effects of biological ageing and physiologically willed him to continuing living to a gargantuan age of over 500 years old.

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