

# Weekly Homework 3

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About Telomeres

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Telomeres represent a concept that can be found in all of the eukaryotic organisms, but there are also several prokaryotic ones which also possess telomeres. They are basically an attachment to the extremities of all our chromosomes, composed from a repeated sequence of nucleotides. This sequence varies from one category to another such as, for vertebrates, let's say, the repetitive sequence is TTAGGG.

Telomeres' main purpose is to protect chromosomes' extremities. They keep on helping chromosomes throughout the replicating DNA process when the enzyme in charge of this function is not able to carry on the entire process. Therefore, at the end of each of these rounds, a small part from the end of the chromosome is left behind. This phenomenon explains the cellular aging.

It is also known for a fact that all the people at the time of their birth start with the same telomere length (which is approximately 11 kilo-bases), but during the time, it was observed that men's telomeres tend to shorten faster than women's telomeres. Since telomeres are associated with aging, they may constitute a plausible explanation for why men's lifespan is more likely to be shorter than women's lifespan.

The most recent discovery regarding telomeres was made in 2009, when Elizabeth Blackburn, together with two other biologists, discovered not only how telomeres protect chromosomes, but also they discovered an enzyme, called telomerase. In a TED Talk from 2017, Elizabeth explains how they've started their research by looking into the cellular division of the ordinary and well known pond scum. Pond scum represented at that time an

interesting and challenging subject given that fact that throughout time, their telomeres wouldn't necessarily decrease, but they can somehow oscillate in length (unlike human chromosomes which keep on shortening). Here comes into the picture telomerase, the enzyme which helps maintaining or, even better, lengthening telomeres. During an experiment, it was shown that when telomerase was removed from pond scum, it died. For us humans, when chromosomes have reached a point where their telomeres are too short, they die and this causes visible signs of aging such as wrinkles or grey hair. Furthermore, it seems that the death of particular chromosomes can increase the risk of heart failure and other diseases. The next question, that probably comes into everyone's mind, is why can't we humans use telomerase as a mechanism for keeping us healthy for a longer period of time? During that TED Talk Elizabeth explains how telomerase can do more harm than good for us humans at the current time. All along the telomeres lengthening process, there could also be triggered severe forms of cancer.

Anyway, another side that is discussed by Elizabeth during that talk is how us, as individuals, can impact the process of telomeres shortening during the time. There's a case study which targets women who have children with different medical conditions. These women are constantly living in stressful conditions and with high responsibilities on their shoulders. After a period of time it was observed that these women could be split into two categories: there were some of them which had shorter telomeres for their age, but there were some that didn't seem affected in particular with their child's situation, based on their telomeres length. When these women were asked how they face their problem, the ones that looked at their child's medical condition as a challenge and didn't freak out about it were also the ones with regularly sized telomeres. As a conclusion, there are multiple social factors which tend to influence how fast our telomeres shorten. Each one of us has power over his or her telomeres, but others' behavior towards one such as violence, bullying and racism could also influence one's telomeres.