Cyanobacterial Replication

*Synechococcus elongatus* is a cyanobacteria, which are often found in bodies of water and are photosynthetic. Being photosynthetic means these prokaryotes gain their energy during the process of photosynthesis. Because they are found in water, they have to have access to areas with plenty of light to follow through with the process of photosynethesis. This bacterium relies heavily on the ability to photosynthesize, gaining its’ energy from the sun, water, and carbon dioxide. *Synechococcus elongatus* is a rod-shaped bacterium and can survive off little nutrients in bodies of freshwater but are typically more abundant in nutrient rich aquatic environments (“Synechococcus elongatus” 2011). This bacterium is made up of a circular chromosome and two plasmids (“Synechococcus elongatus” 2011). Currently, only two strands of the cyanobacteria have been fully sequenced. *Synechococcus elongatus* also have inner and outer cell membranes, these membranes protect the cell and decide what is allowed to come in and out of the cell. These cells also happen to lack flagella or cilia and even with the lack of flagella or cilia, this cyanobacterium still has the ability to move around freely, without influence from light (“Synechococcus elongatus” 2011). *Synechococcus elongatus* even has the ability to produce and sustain a 24-hour clock period (“Synechococcis elongatus” 2011).

 A DNA beta-clamp is promoting factor in DNA replication (“DNA clamp” 2020). The beta clamp works with many proteins and DNA polymerase to properly function in a role of DNA replication. The clamp can be found in bacteria, eukaryotes, archaea, and viruses (“DNA clamp”2020). Each having their own properties that differ when working with the beta-clamp. A DNA beta-clamp must be loaded with their assigned templates, by the specialized proteins, which then disassemble once replication is complete (“DNA clamp” 2020). A single-stranded binding (SSB) protein is found in E. coli and binds to regions of DNA (“Single-strand DNA-binding protein” 2020). SSB binds to regulate the function of the proteins involved in DNA replication (“Single-strand DNA-binding protein” 2020). SSB also plays important roles in maintaining DNA metabolism, specifically replication (“Single-strand DNA-binding protein” 2020).

 A circadian clock is an internal clock that works on a 24-hour time period. When the circadian clock is disrupted or mutated it causes significant problems in living organisms. This includes declined health, reproductive issues, age-related diseases, etc. (Liao and Rust 2021). Replication reaches its’ maximum and minimum levels during the night. The cells are prepared during the night by generating the rhythms in glycogen storage and expressing metabolic enzymes (Liao and Rust 2021). It can take cyanobacteria up to 48 hours to complete 1 round of replication.  *Synechococcus elongatus* has a wide variety of doubling time it needs to grow, that is why it can take so long to replicate the genome (Liao and Rust 2021). DNA replication on the circadian clock is tracked by the use of fluorescent reporters, they allow us to see what is happening (Liao and Rust 2021). We know that DNA replication is tied to the circadian rhythms because of the way they behave. Dark pauses in replication cause replisome to disassemble and abort replication in the dark (Liao and Rust 2021). If the circadian clock becomes mutated, we can also see how that effects DNA replication. It is said that DNA replication could be a main factor of circadian control. (Liao and Rust 2021).

Works cited

“DNA Clamp.” *Wikipedia*, Wikimedia Foundation, 5 Dec. 2020, en.wikipedia.org/wiki/DNA\_clamp.

Liao, Yi, and Michael J Rust. “The Circadian Clock Ensure Successful DNA Replication in Cyanobacteria.” 8 Apr. 2021, https:doi.org/10.1073/pnas.2022516118.

“Single-Strand DNA-Binding Protein.” *Wikipedia*, Wikimedia Foundation, 6 Dec. 2020, en.wikipedia.org/wiki/Single-strand\_DNA-binding\_protein.

“Synechococcus Elongatus.” *Microbewiki*, 7 July 2011, microbewiki.kenyon.edu/index.php/Synechococcus\_elongatus.