Biological Simulation: Exploring Circadian Rhythms on Mars

*RINKA HIGUCHI[1], Michio Kumagai[1], Yasuaki Aota[1]

1. Certified Nonprofit Organization Biwako Trust

This study investigates the feasibility of sustaining life on Mars from the perspective of circadian rhythms. Motivated by an interest in biological rhythms and the potential habitability of Mars, I conducted a simulation to evaluate how solar radiation patterns on Mars align with an ideal human circadian cycle. Using the 3D game engine Unity, I modeled Mars’ s revolution and rotation and divided its surface into 26 regions based on latitude and longitude. Solar radiation in each region was recorded hourly over one Martian year (687 days), with values assigned according to light conditions. An ideal circadian rhythm model consisting of 25 hourly data points per day was defined, assuming a 25-hour cycle. The observed radiation data were compared with the ideal model, and scores were assigned based on the degree of agreement. Regions with higher total scores were considered more suitable for maintaining circadian rhythms. The results show that equatorial regions generally provide stable light conditions and high scores, indicating favorable environments for circadian regulation. In contrast, polar regions exhibit extreme light-dark cycles and lower scores. However, certain polar areas achieved unexpectedly high scores, suggesting that suitability may vary depending on location and season.
These findings indicate that equatorial regions are generally the most suitable for sustaining life on Mars, while some polar regions may also be viable under specific conditions. Future work will extend this analysis to plant models to evaluate the feasibility of photosynthesis on Mars.

Keywords: Mars, Biological, Simulation, Circadian Rhythms

