

Molecular insights into *Leptolyngbya* sp. JSC-1 photoacclimation

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The cyanobacterium *Leptolyngbya* sp. JSC-1 was isolated from a floating microbial mat in an iron-rich thermal spring. Initially studied for its tolerance to oxidative stress and thermotolerance, JSC-1 was later discovered to undergo far-red light (FRL) photoacclimation, the process by which oxygenic phototrophs remodel their photosynthetic apparatus to synthesize Chls *d* and *f* and perform photosynthesis with photons up to ~800 nm. Unlike other FRL-acclimating cyanobacteria, JSC-1 uniquely combines high iron tolerance and thermotolerance, traits advantageous for extraterrestrial environments such as Mars. Despite being the first organism in which FRL photoacclimation was described, no high-resolution molecular structures exist for its photosystems or associated antenna proteins. Toward this goal, here we (a) establish cell growth conditions and (b) perform initial characterizations of the photosynthetic apparatus in JSC-1. Our results begin to establish JSC-1 as a model for understanding the structural and biochemical bases of FRL photoacclimation, quantify its physiological resilience to environmental stressors, and evaluate its potential role in extraterrestrial biomanufacturing systems.