**The diversity of cyanobacterial photosynthetic responses and their implications for oxygenic photosynthesis on exoplanets orbiting M-dwarfs**

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M-dwarf stars are extremely common in our galaxy and could theoretically allow life evolution due to their long lives. However, they are far less luminous than the Sun and emit most of their light in the far red (FR, λ > 750 nm) with only a minority of the light in the Visible (VIS, 400–700 nm), the waveband utilized by the vast majority of oxygenic photosynthetic organisms on Earth. Researchers thus are currently investigating if oxygenic photosynthesis, the most prominent biological process that shaped life evolution on our planet, is feasible under an M-dwarf spectral environment. Oxygenic photosynthesis indeed generates atmospheric and surface biosignatures, which would make it an ideal target for investigating life’s detectability beyond Earth. The capability to face different light regimes is a crucial factor influencing the growth potential of cyanobacteria, the simplest oxygenic photosynthetic organisms. For this reason, several cyanobacteria evolved fine photo-acclimations, termed Chromatic Acclimations (CA), to improve the harvesting of incident wavelengths through their photosynthetic pigments. Through CA, some cyanobacteria modulate the relative ratio of visible-absorbing pigments to maximize VIS absorption, while others can perform complex reorganizations of the photosynthetic apparatus and/or synthesize novel, far-red-absorbing chlorophylls to absorb FR efficiently [1]. In nature, these strains can hence perform oxygenic photosynthesis in environments like the subsurface and microbial mats, characterized by low luminosity and/or enriched in FR light. Recently, we demonstrated that some of these cyanobacteria could survive and grow when exposed to a simulated M-dwarf light spectrum, investigating also the acclimation responses behind their growth, at a physiological and molecular level [2–4]. The proposed talk will offer an overview of some of the cyanobacterial acclimation strategies to low-luminosity, FR-enriched and simulated M-dwarf light spectra, including our recent findings on a species, *Synechococcus* sp. PCC7335, capable of multiple CA (for low, VIS and FR light absorption), and highlight why they are extremely informative for assessing the plausibility of oxygenic photosynthesis on exoplanets orbiting M-dwarfs.

[1] Sanfilippo, J. E. et al. Annu. Rev. Microbiol. **73**, 407–433 (2019)

[2] Claudi, R. et al. Life **11**, 10 (2020)

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