Bioelectricity production and photosynthetic characterization of the highly exoelectrogenic green alga *Parachlorella kessleri* MACC-38

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Exoelectrogenesis is a term denoting the electron export out of living cells. Algae inherently combine exoelectrogenesis with photosynthesis which makes them an excellent choice as a living partner in bio-hybrid devices for transformation of light into electric current in biophotovoltaics or for electrosynthesis.

We recently identified a green algal strain *Parachlorella kessleri* MACC-38 with exceptional exoelectrogenic properties. MACC-38 is capable of producing up to 10 times higher ferricyanide-mediated electric current than model green alga *Chlamydomonas reinhardtii*. In our current work, we aim to reveal particular photosynthetic characteristics of this strain that sustain such massive electron export and possibly mitigate its effect on cellular redox state.

We found that, in MACC-38, light-induced current is sustained not only by the photosynthetic electron transport chain (PETC), but also by the oxidative pentose phosphate pathway (OPPP). Together PETC and OPPP provide reducing power for electron export in the form of NADPH. However, the activation of OPPP leads to over-saturation of PETC. Interestingly, we found that another specific trait of MACC-38 is its heavy reliance on chlororespiration (mediated by the plastid terminal oxidase, PTOX) to mitigate the oversaturation of PETC.

Our work provides the first insights into the physiological mechanisms of increased light-induced electric current production in green algae and paves the way towards new startegies to maximize solar energy capture.