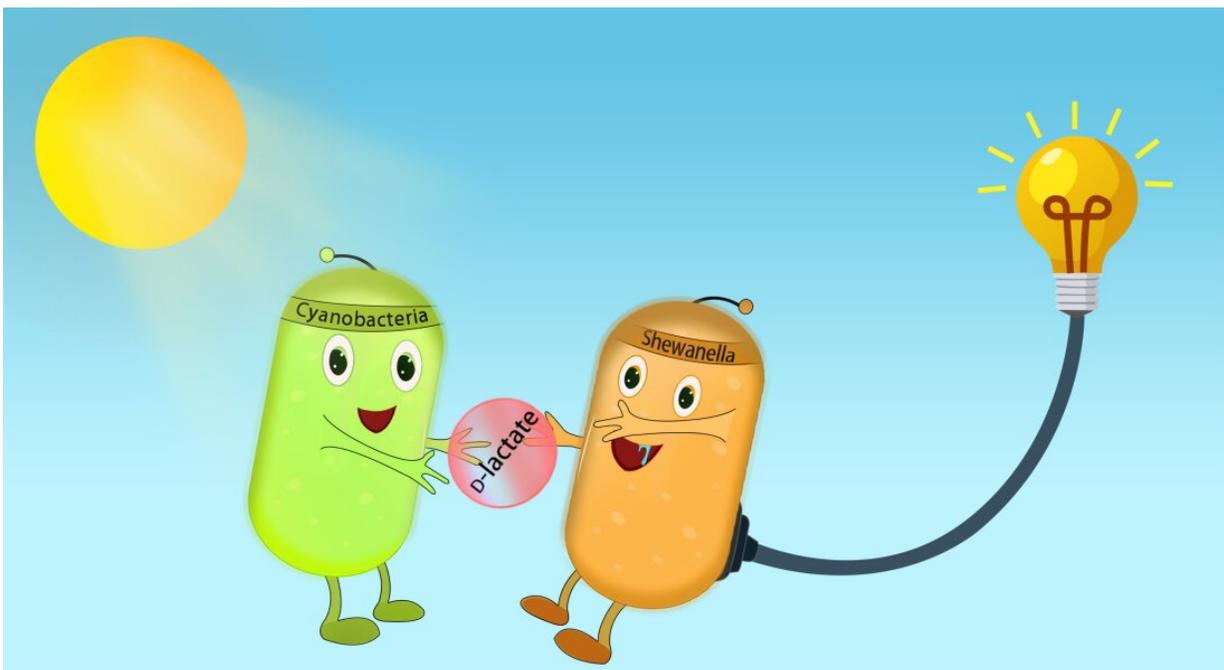


Scientists develop novel biophotovoltaics system

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A cartoon diagram of BPV system based on a two-species microbial consortium. Credit: Image from LI Yin's group, Institute of Microbiology, Chinese Academy of Sciences

Researchers from the Institute of Microbiology of the Chinese Academy of Sciences have reported a novel biophotovoltaics (BPV) system based on a synthetic microbial consortium with constrained electron flow. This BPV system can stably operate for more than 40 days, setting a new

BPV longevity milestone, according to a recent article in *Nature Communications*.

BPV is an emerging technology that employs biological photosynthetic materials (mainly living photosynthetic microorganisms) to convert solar energy into electricity. BPV is more environmentally friendly and potentially more cost-effective than semiconductor-based photovoltaics (PV), given the toxicity and hard-to-recycle nature of PV materials.

However, the [power](#) densities of BPV systems reported to date have been low, since photosynthetic microorganisms have a weak capacity to transfer electrons outside cells. To circumvent this problem, researchers have created a two-species microbial consortium.

This microbial consortium is composed of photosynthetic cyanobacteria and the exoelectrogenic bacteria *Shewanella*, with the latter inherently possessing strong exoelectrogenic activity. D-lactate was selected as the energy carrier responsible for directed energy transfer between cyanobacteria and *Shewanella* (Fig. 1).

In this microbial consortium, cyanobacteria capture [solar energy](#) and fix CO₂ to synthesize D-lactate, while *Shewanella* produce electricity by oxidizing D-lactate, thus creating a constrained electron flow from photons to D-lactate, then to electricity.

Through [genetic manipulation](#), as well as manipulation of the growth medium and device, the two very different microorganisms are able to work together effectively. This BPV system generates a power density of 150 mW·m⁻² in a temporal separation setup, which is approximately one order of magnitude greater than mediator-less BPV devices with conventional configurations.

The researchers further demonstrated that this BPV system can stably

operate for more than 40 days at an average [power density](#) of 135 $\text{mW}\cdot\text{m}^{-2}$ in a spatial-temporal separation setup with medium replenishment. This represents the greatest longevity and [power output](#) per device of any BPV system reported to date.

More information: Huawei Zhu et al, Development of a longevous two-species biophotovoltaics with constrained electron flow, *Nature Communications* (2019). [DOI: 10.1038/s41467-019-12190-w](https://doi.org/10.1038/s41467-019-12190-w)

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