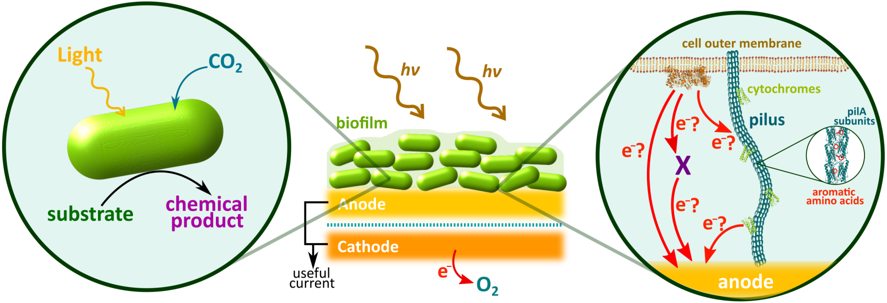
Electron transport in photosynthetic biofilms

Mary Wood

08th October 2024

Biophotovoltaics



Biophotovoltaics in action

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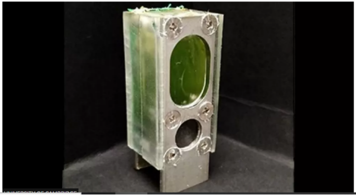
University of Cambridge researchers use algae to power computer

14 May 2022



INDEPENDENT

Scientists create computer powered by algae that will never run out of battery

The system has been working continuously for a year using only light and water as fuel

Adam Smith • Monday 16 May 2022 13:38 • 3 Comments

Biophotovoltaics in action

Bioresource Technology 282 (2019) 171–178

Contents lists available at ScienceDirect

Bioresource Technology

journal homepage: www.elsevier.com/locate/biortech

ELSEVIER

Mixed-species biofilms for high-cell-density application of *Synechocystis* sp. PCC 6803 in capillary reactors for continuous cyclohexane oxidation to cyclohexanol

Check for updates

Anna Hoschek[1], Ingeborg Heuschkel[1], Andreas Schmid, Bruno Bühler, Rohan Karande*, Katja Bühler

Department of Solar Materials, Helmholtz-Ce

ARTICLE INFO

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Cytochrome P450 monooxygenase

Journal of Applied Phycology (2020) 32:1103–1115
https://doi.org/10.1007/s10811-019-02032-z

Enhanced hydrogen production by *Nostoc* sp. CU2561 immobilized in a novel agar bead

Check for updates

Thadcha Sukrachan[1,2] · Aran Incharoensakdi[1,3]

Received: 21 August 2019 / Revised

Abstract
A large number of microalgae
efficient microalga, identified
hydrogen production rate. *Nos*
of nitrogen and sulfur (BG11-
cell immobilization. The high

Green Chemistry

ROYAL SOCIETY OF CHEMISTRY

PAPER

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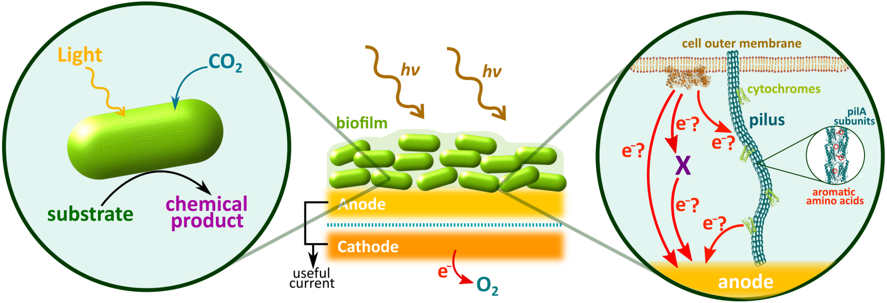
Cite this: *Green Chem.*, 2020, **22**, 6404

Towards sustainable ethylene production with cyanobacterial artificial biofilms†

Sindhujaa Vajravel, Sema Sirin, Sergey Kosourov and Yagut Allahverdiyeva*

Photosynthetic cyanobacteria hold a great potential for the direct conversion of solar energy and CO_2 into 'green' ethylene. The present study aims to develop a thin-layer artificial biofilm technology for sustainable and long-term ethylene photoproduction, where recombinant *Synechocystis* sp. PCC 6803 cells holding ethylene forming enzyme (Efe) from *Pseudomonas syringae* are entrapped within the natural polymer matrix, thus forming the thin-layer biocatalytic structure. The production system was optimized by varying different parameters, such as radiance, inorganic carbon level, and periodicity of medium

Limitations

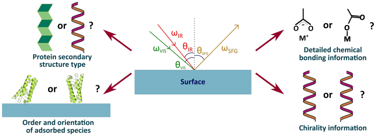


Outstanding questions

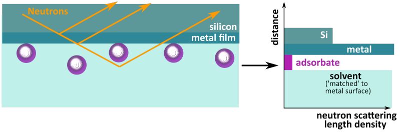
- What are the electron-transfer mechanisms between the biofilm and electrode?
- How could these be improved?

Techniques

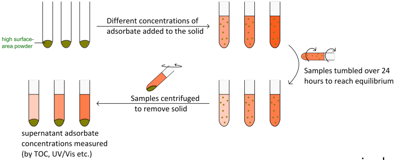
SFG/other IR surface techniques

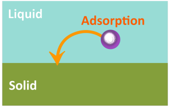


Neutron reflectometry

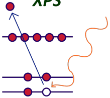


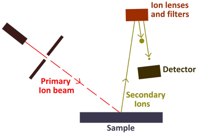
Depletion isotherms





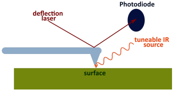
XPS



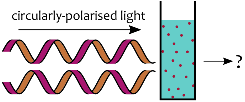


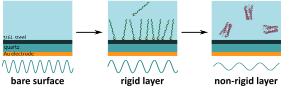
TOF-SIMS

AFM-IR



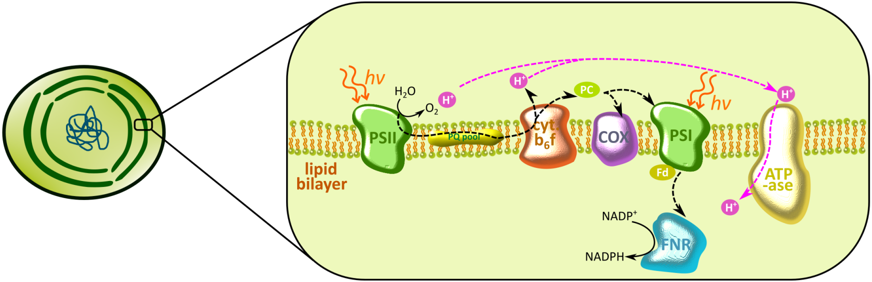
Circular dichroism



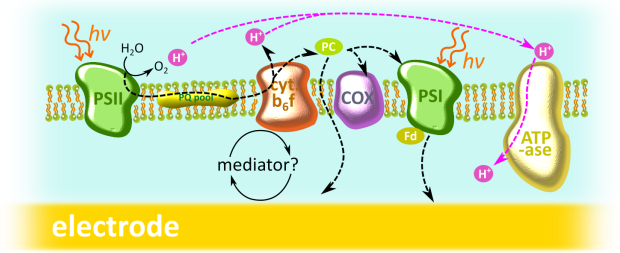


QCM-D/FBAR

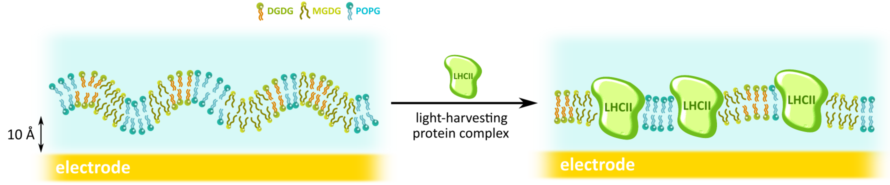
Example: thylakoid membranes



Example: thylakoid membranes



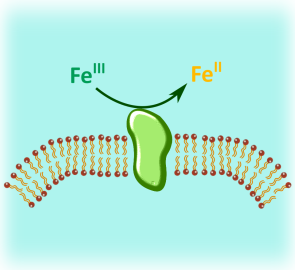
Example: thylakoid membranes



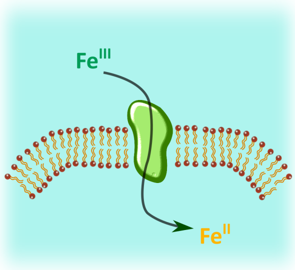
- Buckled bilayer with buffer layer.
- Only forms at < -400 mV (vs SHE).
- Irreversible adsorption.

- Bilayer flat but asymmetric.
- Potential-dependent reversible adsorption.
- Light-dependent proximity to electrode.

Example: Fe mapping



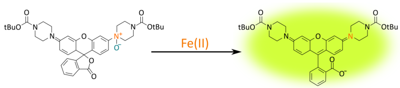
dissimilatory



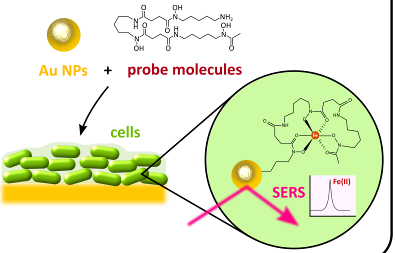
assimilatory

Example: Fe mapping

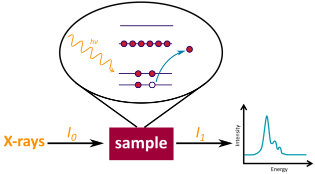
FLUORESCENCE MICROSCOPY



SURFACE-ENHANCED RAMAN MICROSCOPY

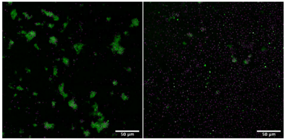


X-RAY ABSORPTION SPECTROSCOPY



Example: Fe mapping

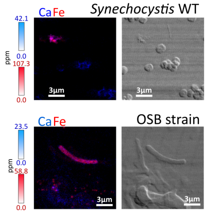
FLUORESCENCE MICROSCOPY

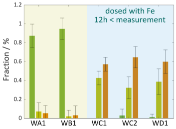


Fe(II) in extracellular clumps

Fe(II) around single 'hot' cells

X-RAY ABSORPTION SPECTROSCOPY





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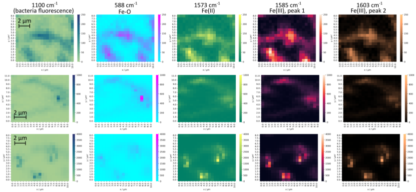

⟶ Fe(II) detected on outer cell membrane (light/dark dependent).

Extracellular matrix—a big unknown