

Ongoing activities in the Molecular Plant Biology unit

PhD Lauri Nikkanen



Molecular Plant Biology staff

Prof: Yagut Allahverdiyeva-Rinne, Paula Mulo, Eevi Rintamäki

Assis. Prof. (tenure track) Pauli Kallio, Mikko Tikkanen
University lecturers: Taina Tyystjärvi, Esa Tyystjärvi.

Academician: Eva-Mari Aro

Senior/Junior/Postdoctoral researchers - 20

PhD students - 15

Technical staff - 4

About 40 % non-Finnish



Yagut Allahverdiyeva
Photosynthesis & biotechnology



Paula Mulo
Regulation of photosynthesis; acetylation and FNRs



Eevi Rintamäki
Redox networks in plant chloroplasts



Pauli Kallio
Synthetic biology of cyanobacteria



Mikko Tikkanen
Photosynthesis



Taina Tyystjärvi
RNA polymerase of cyanobacteria



Esa Tyystjärvi
Plant biophysics



Eva-Mari Aro
Photosynthesis

Oxygenic Photosynthetic organisms:

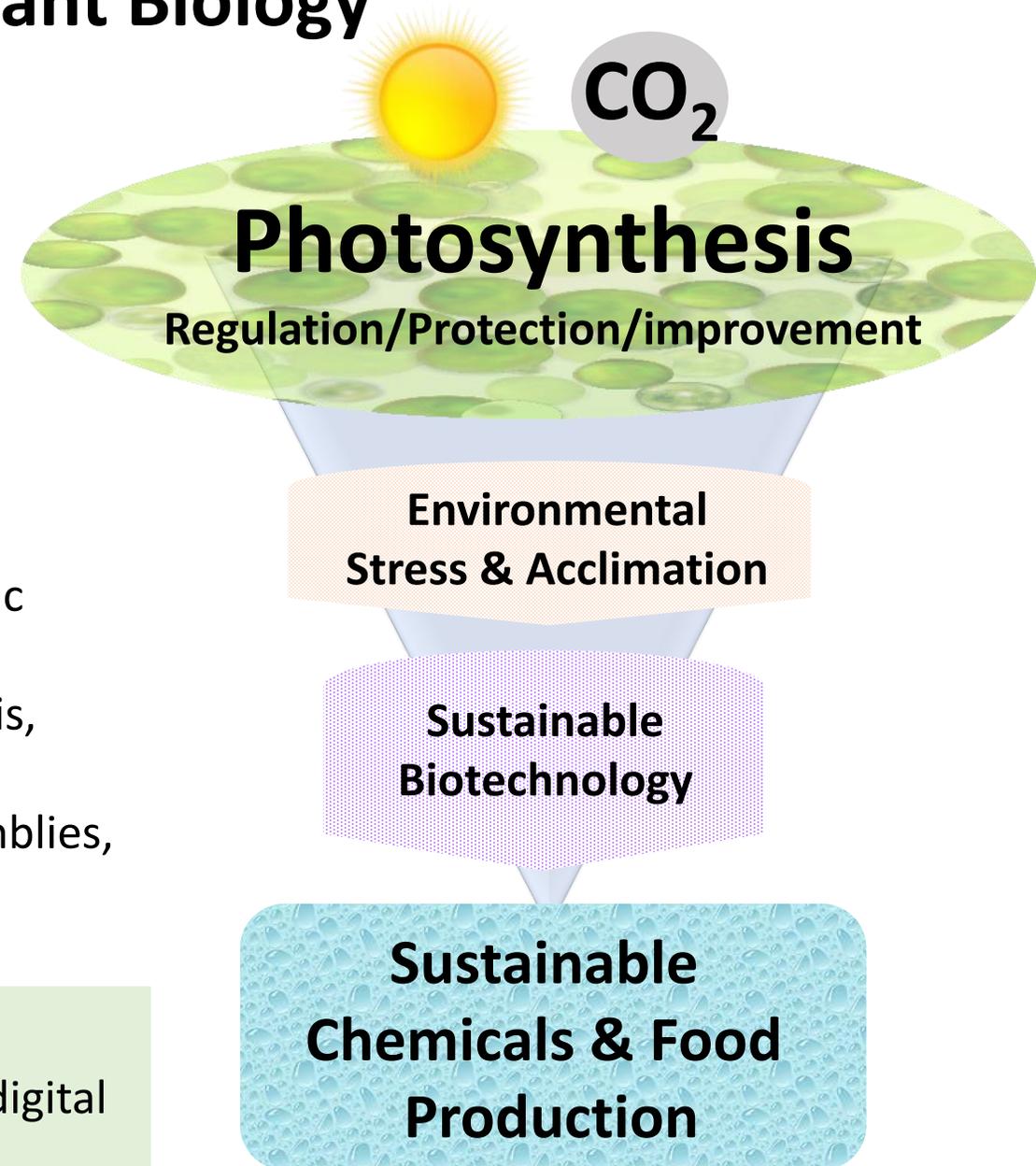
Cyanobacteria, Algae, Plants

Multidisciplinary plant and microbial research:

- Molecular biology, Physiology, Biophysics, Biochemistry, PhotoBioElectrochemistry
- Systems biology, Functional genomics, Proteomics, Synthetic biology
- Biotechnologies (cell factories, semi-artificial photosynthesis, wastewater treatment, biorefinery, urban agriculture)
- Material sciences (CO₂ & light capturing cell-material assemblies, cell material interaction)

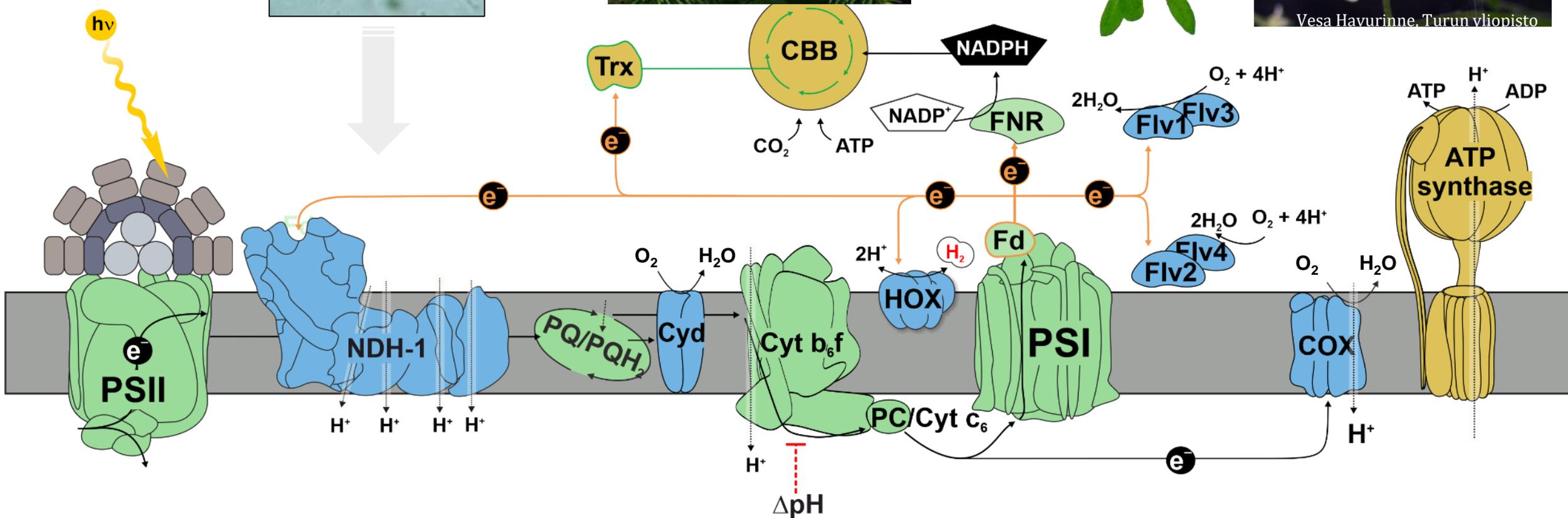
UTU strategic research profiling area:

Biodiversity and sustainability and Future Technologies and digital society

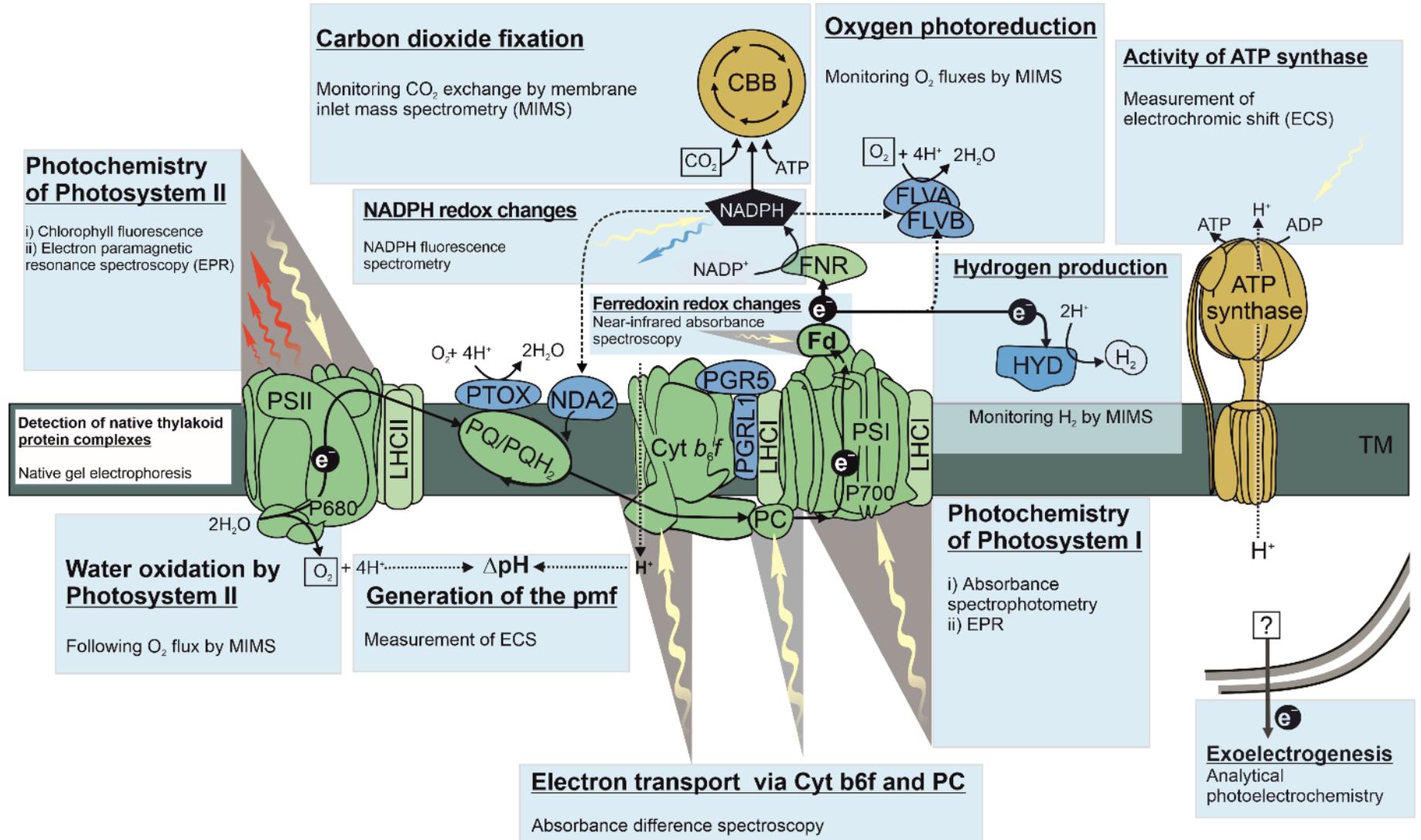
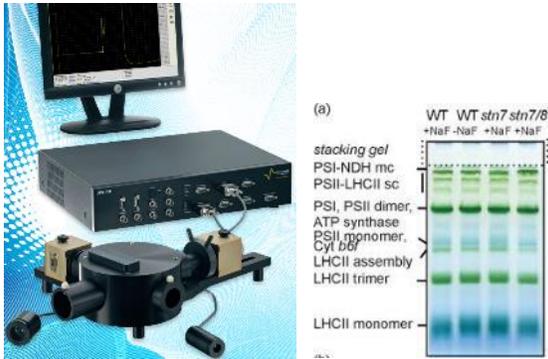
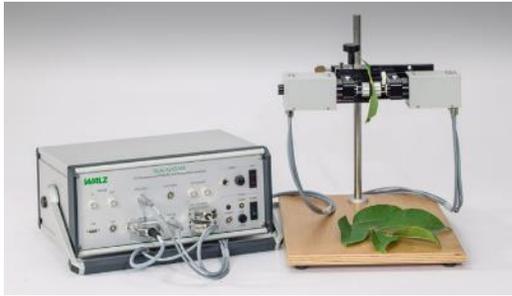


Photosynthesis as a starting point

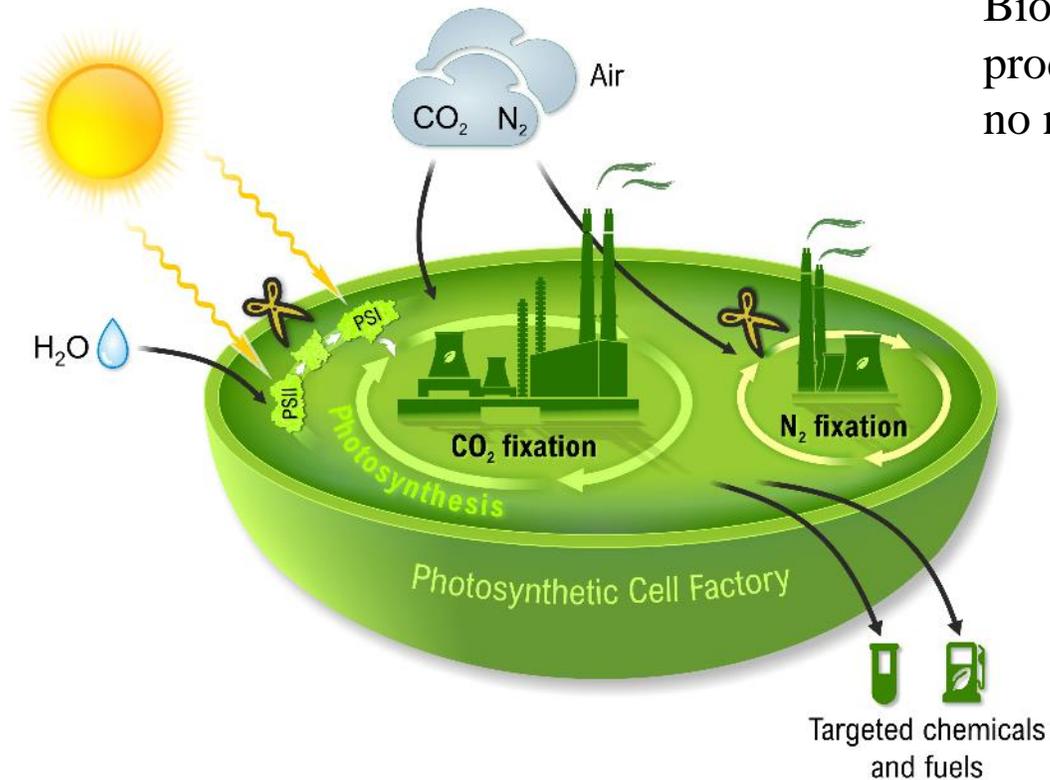
- Our life is supported by photosynthesis. It sustains most ecosystems and generates O_2 as a by-product
- Splits water using light energy & makes organic molecules out of inorganic materials (CO_2 and H_2O).



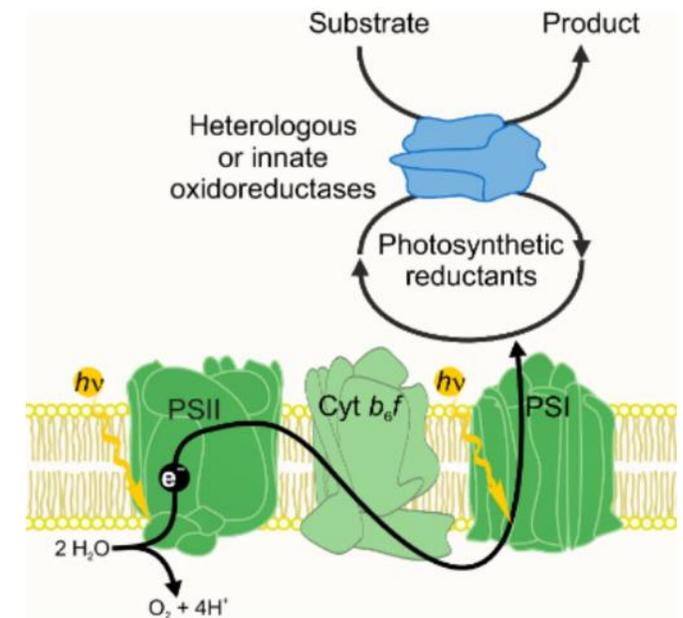
Probing photosynthesis



Biocatalytic solar chemicals/fuel production by photosynthetic cell factories



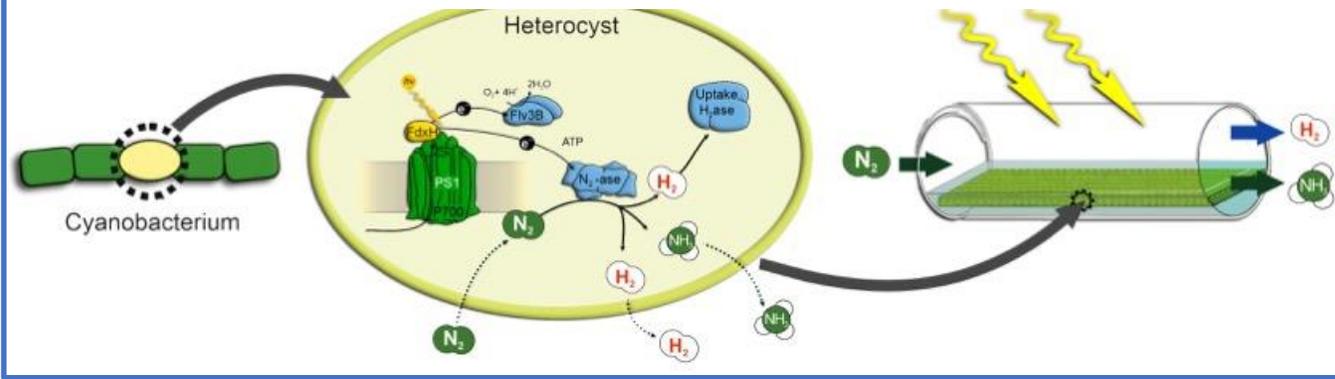
Bioproduction of an expanding suite of products *via* solar energy conversion - no need to take up arable land



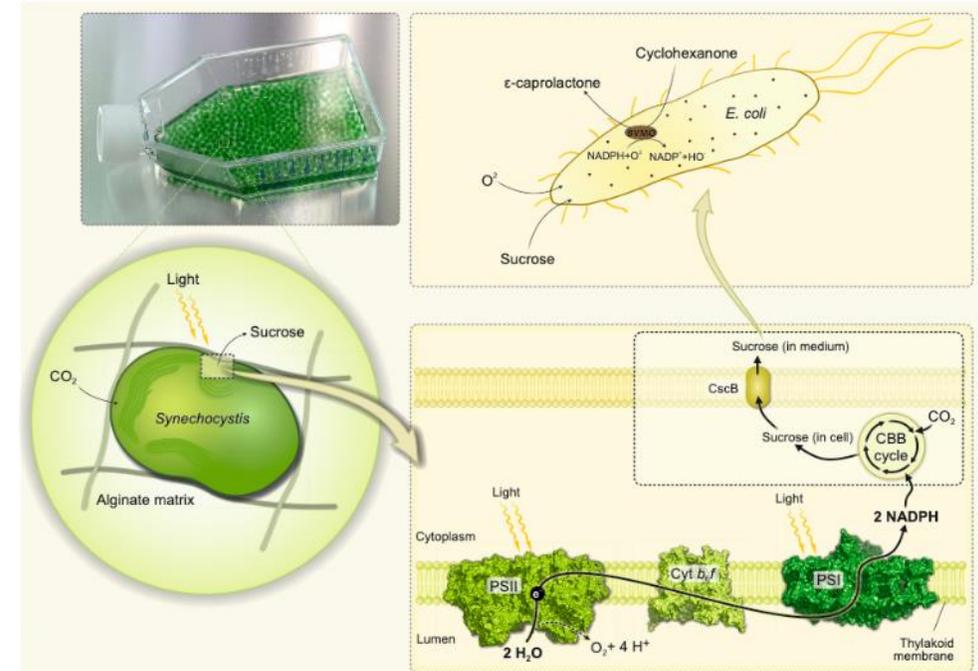
High energy efficiency when using reducing power directly from the photosynthetic electron transport chain

Development of solid state cell factories: Encapsulation of cells for efficient bioproduction

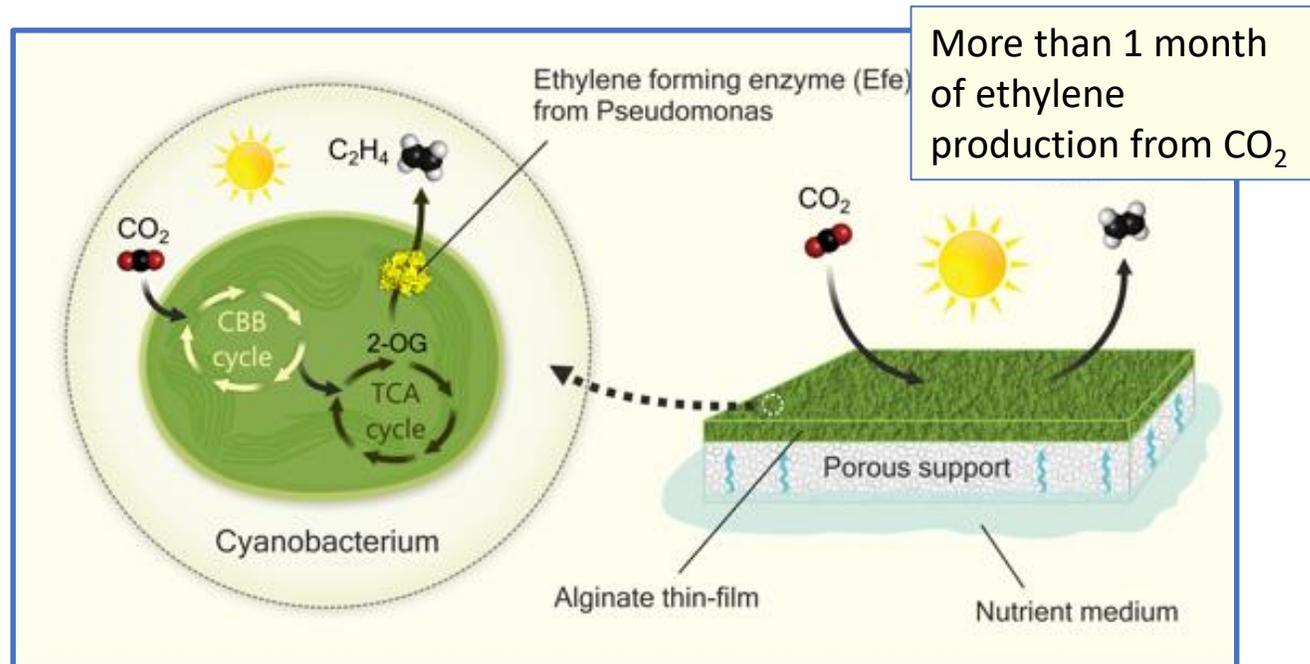
Solar driven ammonia production from atmospheric N₂



Coupling photosynthetic sucrose production and biotransformation in *E. coli*



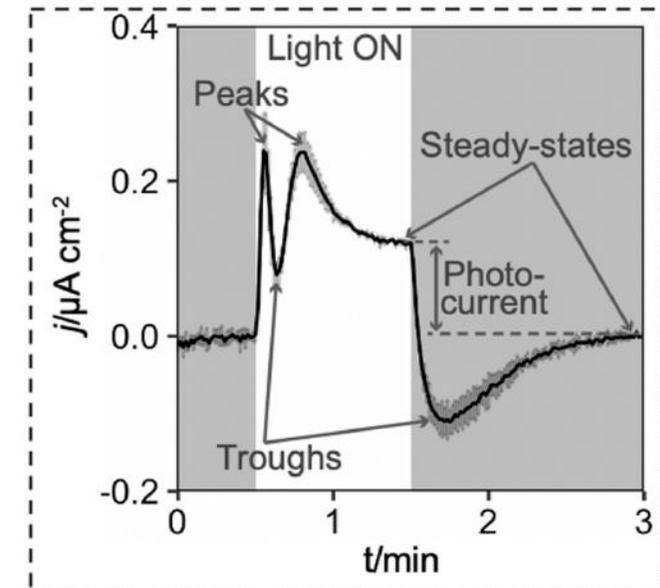
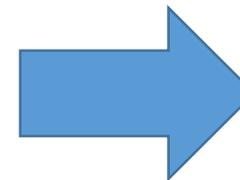
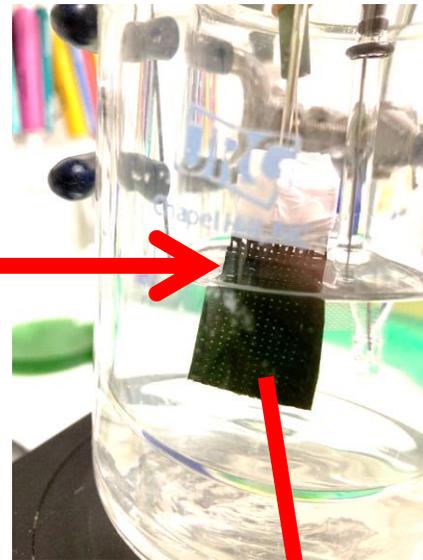
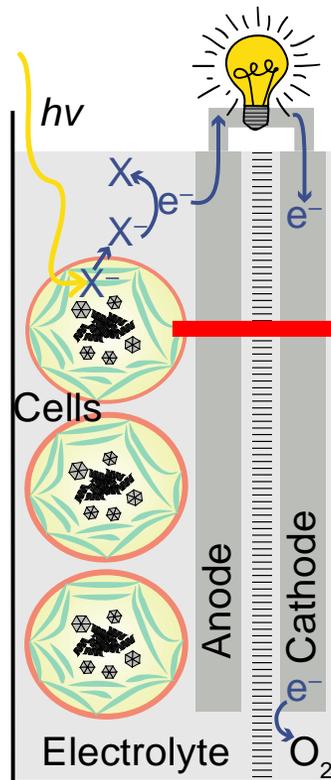
More than 1 month of ethylene production from CO₂



Toth et al. submitted
Vajravel et al. 2020 Green Chemistry
Volgusheva et al. 2019 J Biotechnology
Rissanen et al. 2021 Green Chemistry

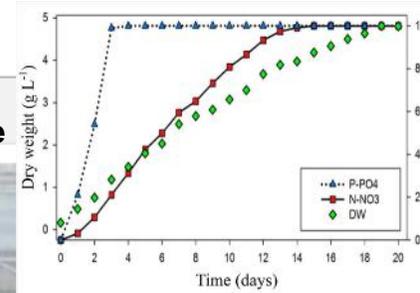
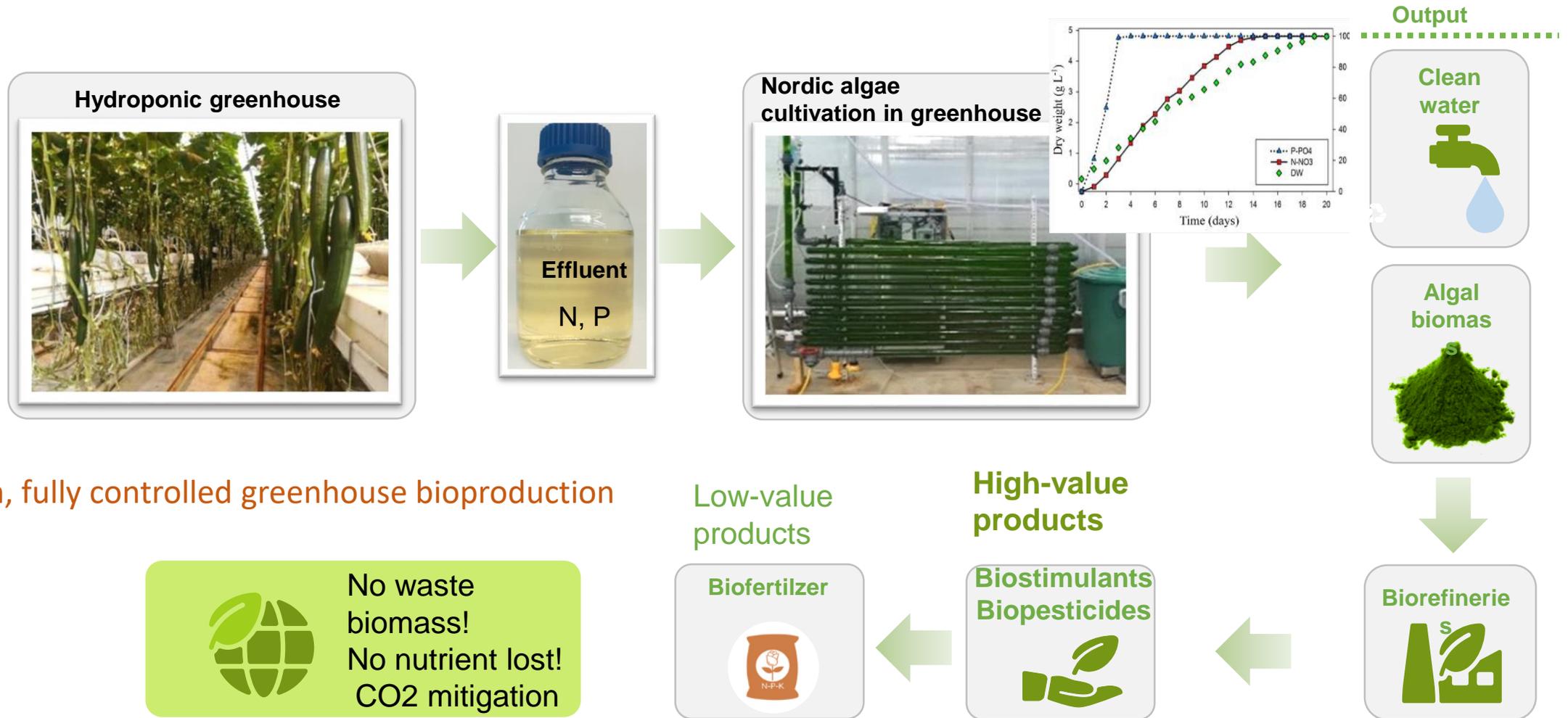
Green electricity from photosynthetic microbes

- Photosynthetic microorganisms export electrons outside the cell
 - Biological function or mechanism not known – but depends of photosynthesis!
 - Can be harnessed to power electric devices or generate electricity



Lund et al. 2022 Carbon Trend
 Latonen et al. 2021 ACS Appl. Bio Mater.
 Wey et al. 2021 Electrochimica Acta

Circular economy concept: nutrient recovery from greenhouse effluent and sustainable bio-agrochemicals production



Data driven, fully controlled greenhouse bioproduction



KONEEN SÄÄTIÖ



BUSINESS
FINLAND



novo nordisk fonden

