

Challenges and recent results in microalgae research

Graz, 2020 January 22nd

Katharina Meixner

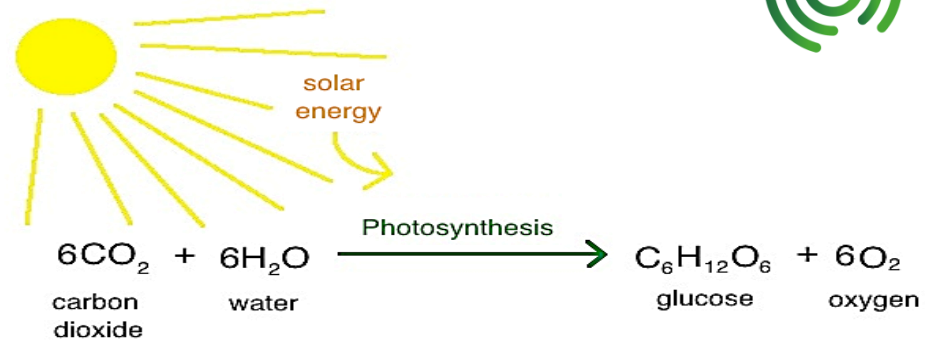


What are Algae?

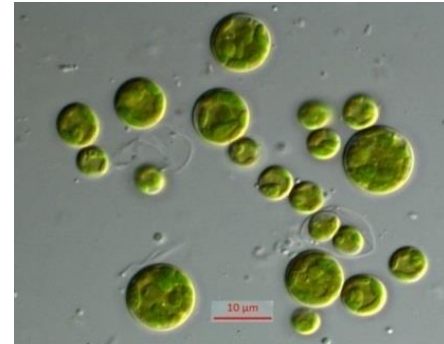
- Informal term for a large, diverse group of photosynthetic organisms
- Macro -



© J. Murphy (2012) IEA Biogas Country Report Ireland



Microalgae



© M. Gruber, IFA Tulln



Microalgae

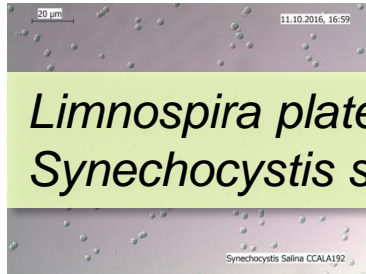
- Eukaryotes



Chlorella vulgaris, *C. sorokiniana*,
Nannochloropsis limnetica,
Acutodesmus obliquus (*Scenedesmus*)

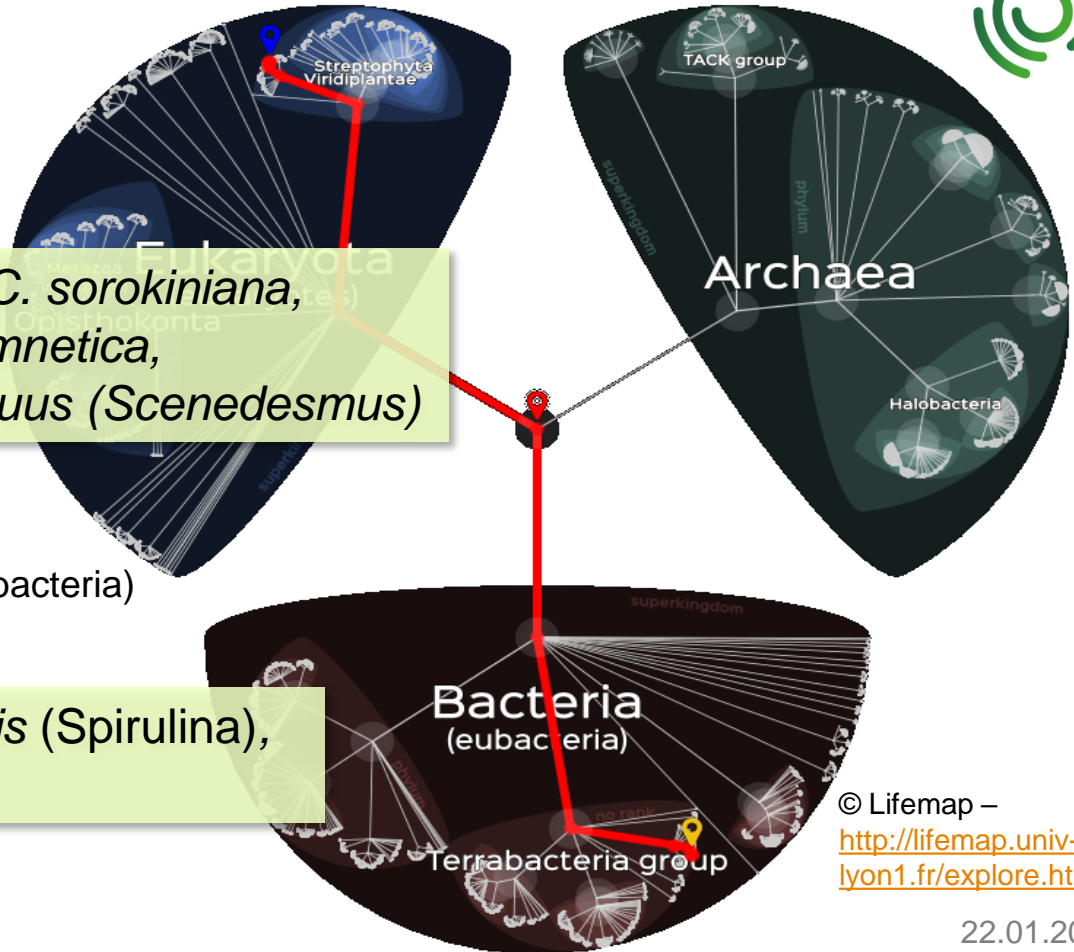
© M. Gruber, IFA Tulln

- Prokaryotes (Cyanobacteria)



Limnospira platensis (Spirulina),
Synechocystis sp.,

© C. Troschl, IFA Tulln



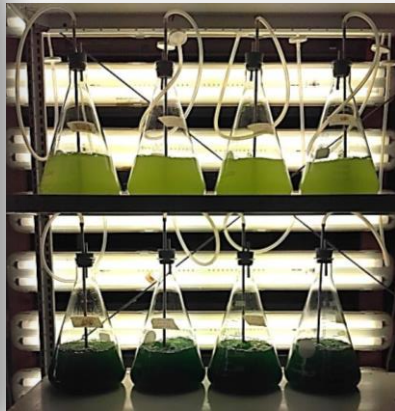
© Lifemap –
<http://lifemap.univ-lyon1.fr/explore.html#>

22.01.2020

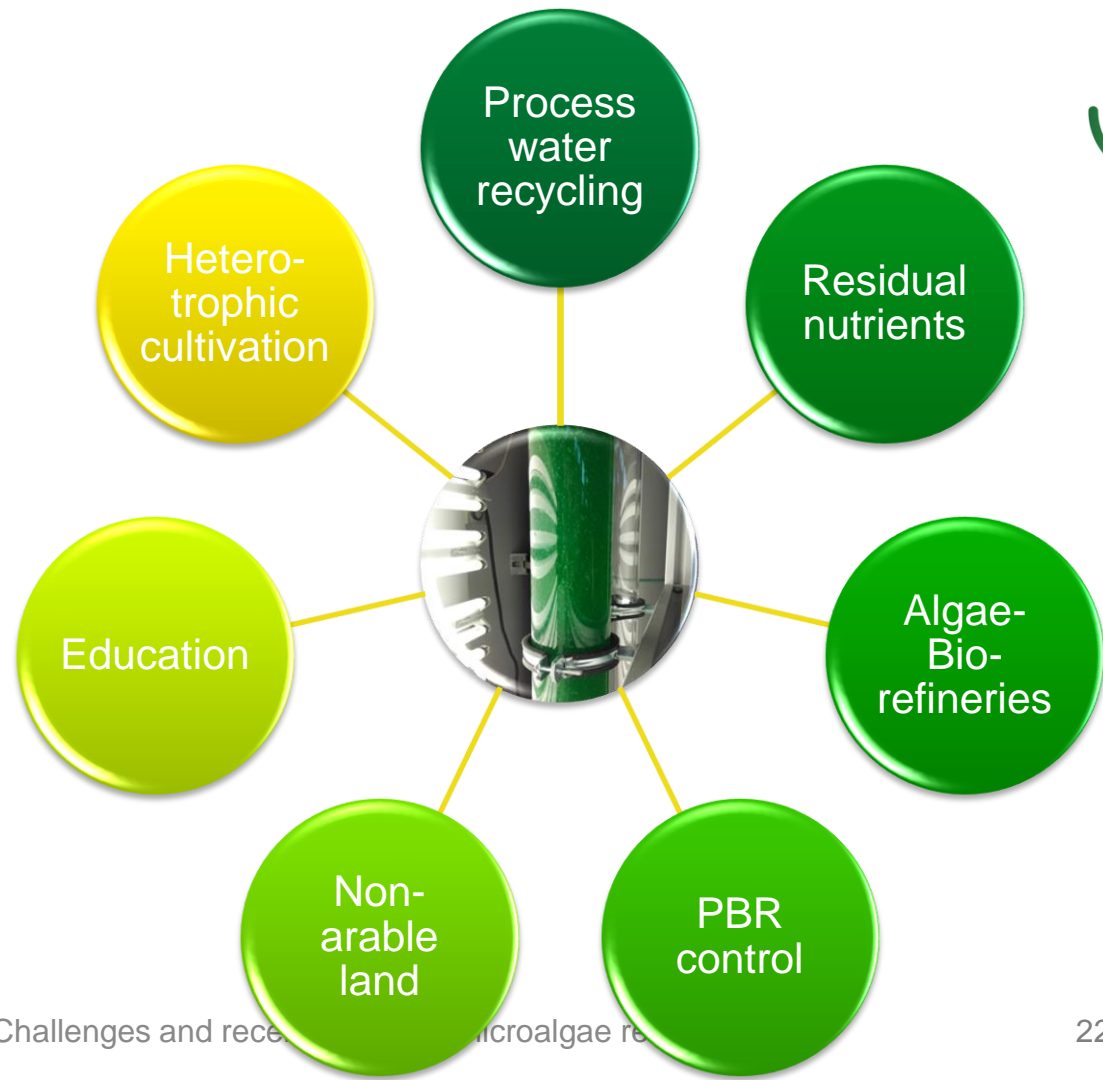


Cultivation systems

- Photoautotroph:
 - CO₂-incubator
 - Illuminated shelves
 - Bubble columns
 - PBRs (5L, 15L, 200L)
- Hetero-/Mixotroph
 - INFORS System
 - 100L-Reactors

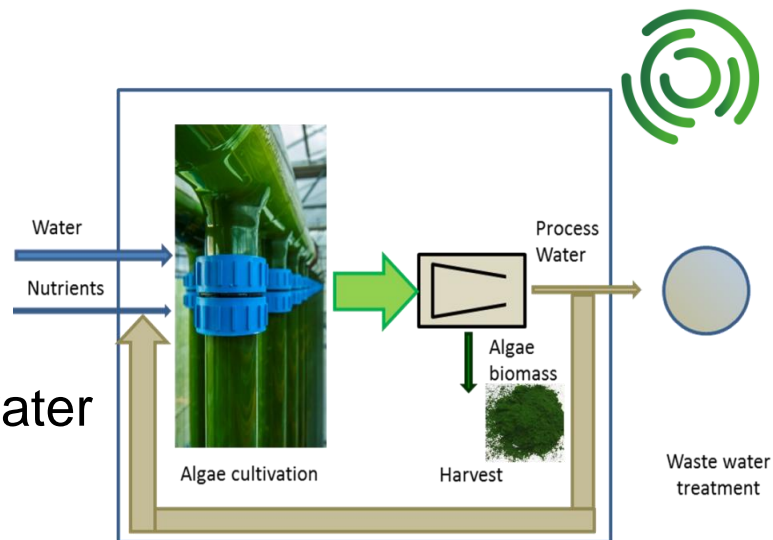


Challenges



Process water recirculation

- Increase recirculation of algae-process water for saving water and nutrients and reduce wastewater



Results

- Organic content was reduced by using FeCl_3 .
- Pigments, proteins and lipids decreased with increasing number of recirculations.
- Costs for fresh water and wastewater can be reduced by 80-82 % and for nutrient consumption by 14-35%



Heterotrophic cultivation

- Heterotrophic and axenic cultivation of algae strains for the production of food grade biomass and PUFAs

Results

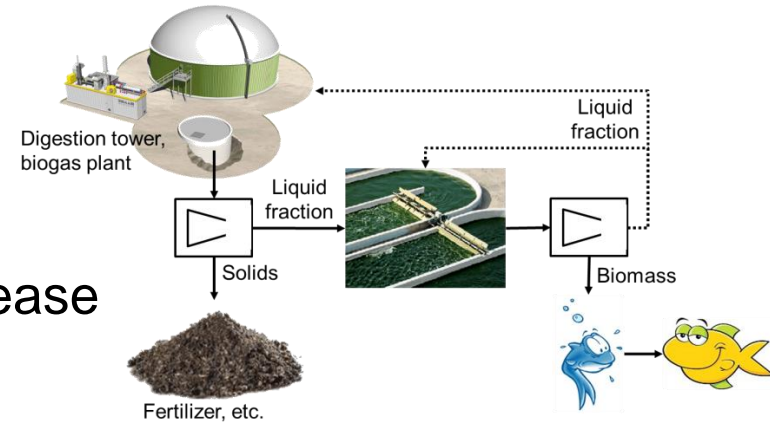
- Successful heterotrophic cultivation at 60L scale for *Chlorella vulgaris* biomass production
- Selection of high-producers of PUFAs and identification of fatty acid spectra





Residues as nutrient source

- Utilisation of effluents as nutrient source for cultivating algae and algae biomass as fish feed to increase the efficiency of AD facilities



Results

- WW not feasible as nutrient source
- Food waste digestate most promising
 - Fewest treatment steps required and biomass suitable for fish feed, but no EPA, DHA
- Reduction of N lowers required dilution and shows best growth

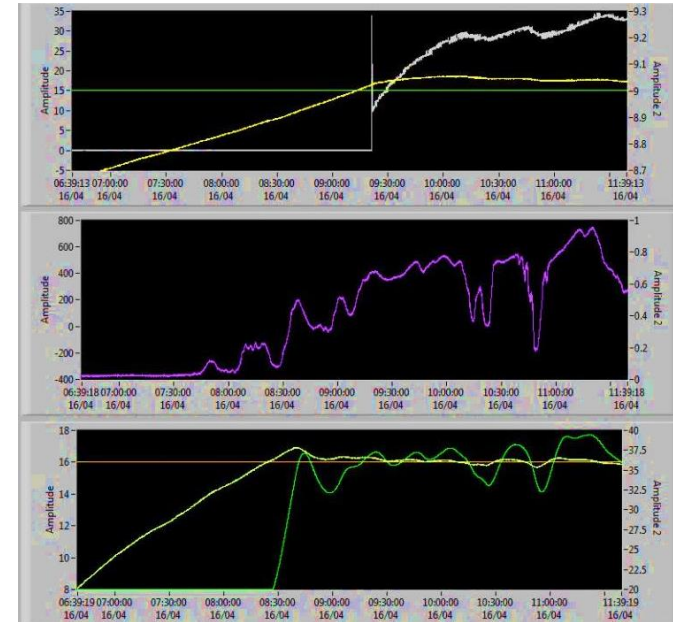


Photobioreactor control system

- Optimising the control and automatization of biotechnological processes
 - WP1: tubular photobioreactor

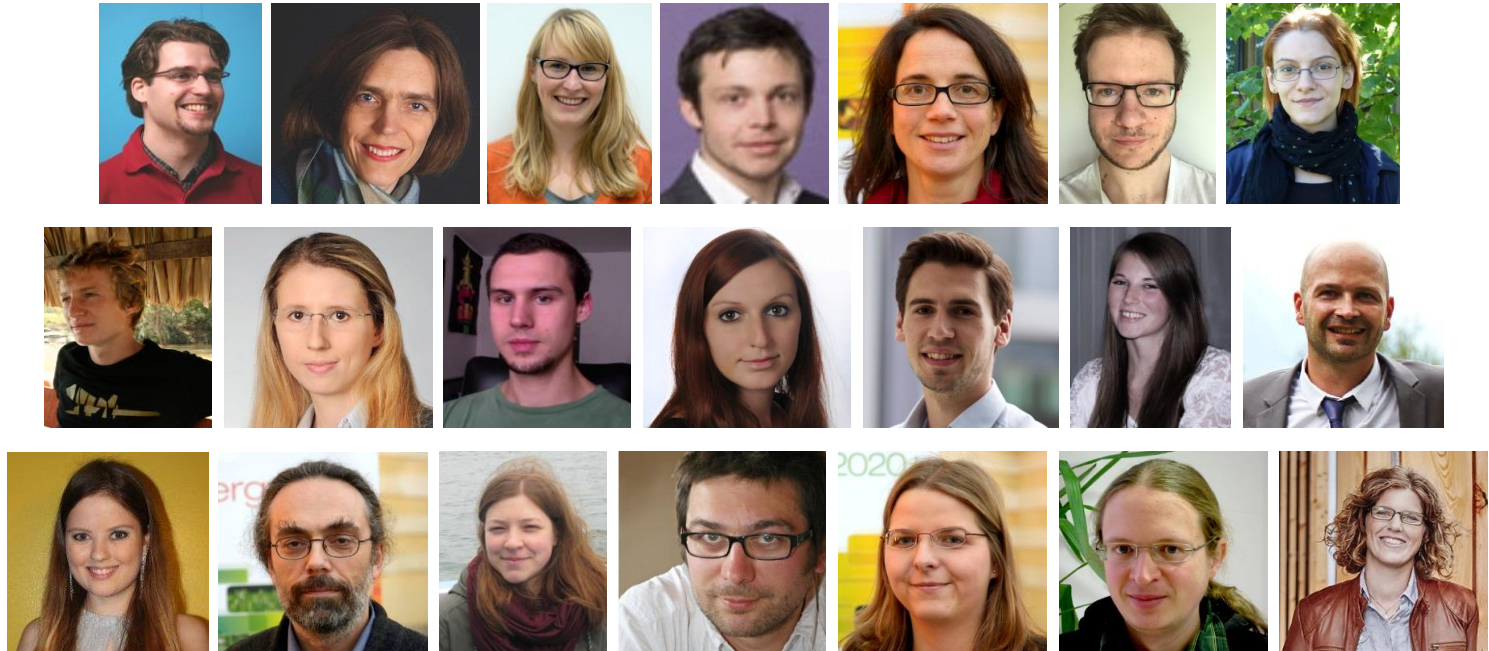
Results

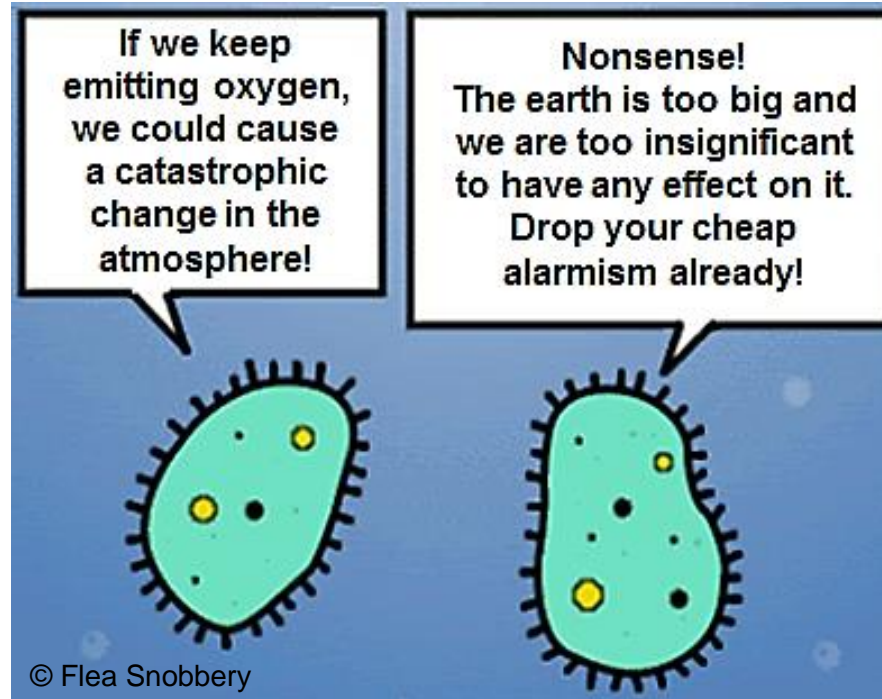
- Improvement of CO₂-injection based on pH-value via PID-controller
- Control of pumping speed based on O₂-concentration





Thanks to all BEST-Algae-Supporter







BEST

Bioenergy and
Sustainable Technologies

