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UNIVERSITY OF LISBON
INTERDISCIPLINARY STUDIES
ON SUSTAINABLE ENVIRONMENT AND SEAS

MICROALGAE BIOMASS AS A SUSTAINABLE FOOD SOURCE

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SESSION II - History and social aspects about microalgae biomass cultivation

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SESSION II - History and social aspects about microalgae biomass cultivation

SUMMARY

Microalgae in the timeline

The birth of microalgae biotechnology

Microalgae cultivation: relevant aspects in social terms

Evolution of microalgae cultivation

Biorefinery concept

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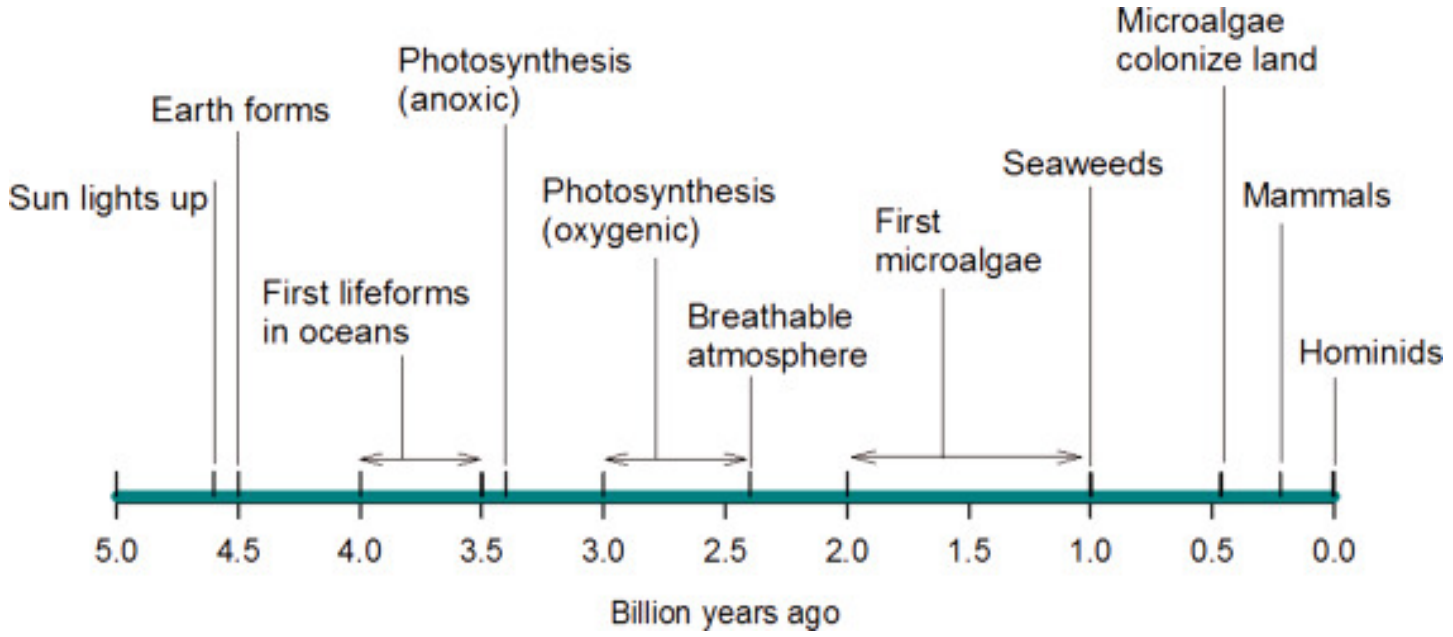
The appearance of the first oxygen producer: an important milestone for life on the planet!



Are microalgae really new?

Aztec harvesting Spirulina from lakes in Mexico.
Drawing in Human Nature, March 1978, by Peter T. Furst.

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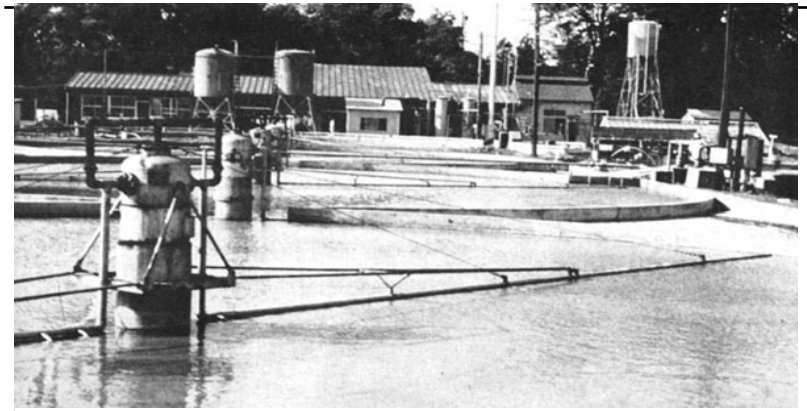
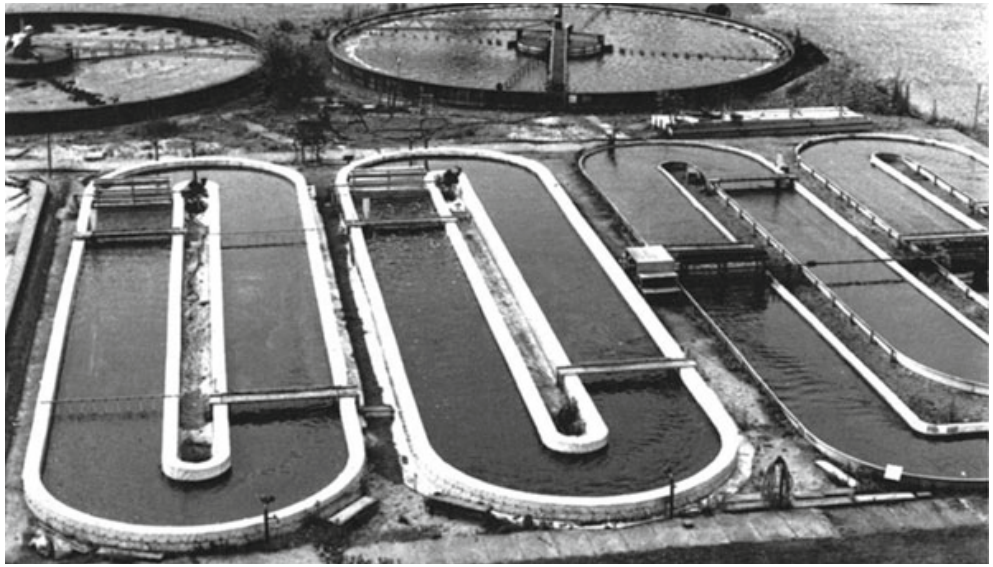


Circular algae ponds at the Japanese Microalgae Research Institute at Kunitachi-machi, Tokyo (From Krauss 1962)

Commercial Chlorella production farm near Taipei, Taiwan

Microalgal biotechnology has emerged due to the health-promoting properties of microalgae related to their bioactive compounds and the great diversity of products that can be developed from algal biomass.



The outdoor algae ponds at the Gesellschaft für Strahlen- und Umweltforschung, Dortmund, Germany. The raceway ponds in the foreground are 20 m long and the circular ponds in the background have a diameter of 16 m (From Soeder 1976)

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Microalgae saved Japan from starving during the embargo following the Second World War…

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Microalgae cultivation – traditional activity in the Eastern countries

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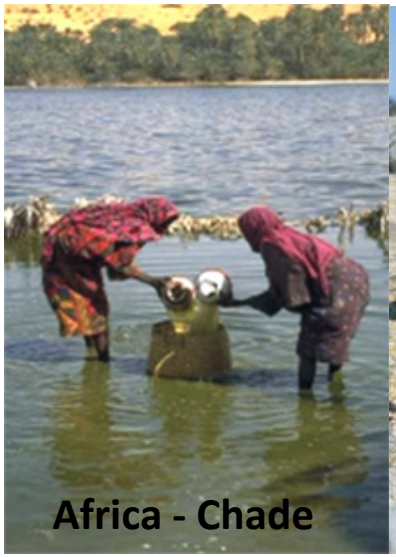
The beneficial health effects that result from the consumption of microalgae have been recognized over time…

The accumulation of high amounts of bioactive compounds (antioxidants, emega-3 fatty acids, anti-inflammatory...) has led to them being **recognized as super foods**!

Development of microalgae biotechnology

Microalgae cultivation - very relevant aspects in social terms



Nutrient-rich algae (spirulina) from Chad could help fight malnutrition

Dihé boosts local women's incomes; women selling traditional Dihé at market

http://www.fao.org/news/story/en/item/44388/icode/

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Microalgae – a tool against malnutritiom

In India, the **Antenna Nutritech Foundation** promotes the consumption of Spirulina to prevent infant malnutrition.

Green candies with 3 flavours…

Intergovernmental Institution for the Use of Micro-Algae Spirulina Against Malnutrition (IIMSAM), Intergovernmental Observer to the United Nations Economic and Social Council, encourages the case for 'Spirulina Platensis' in the fight against malnutrition – the world's number one killer. https://lifesly.com/iimsam-accelerates-efforts-towards-bringing-spirulina-to-populations-suffering-from-malnutrition/

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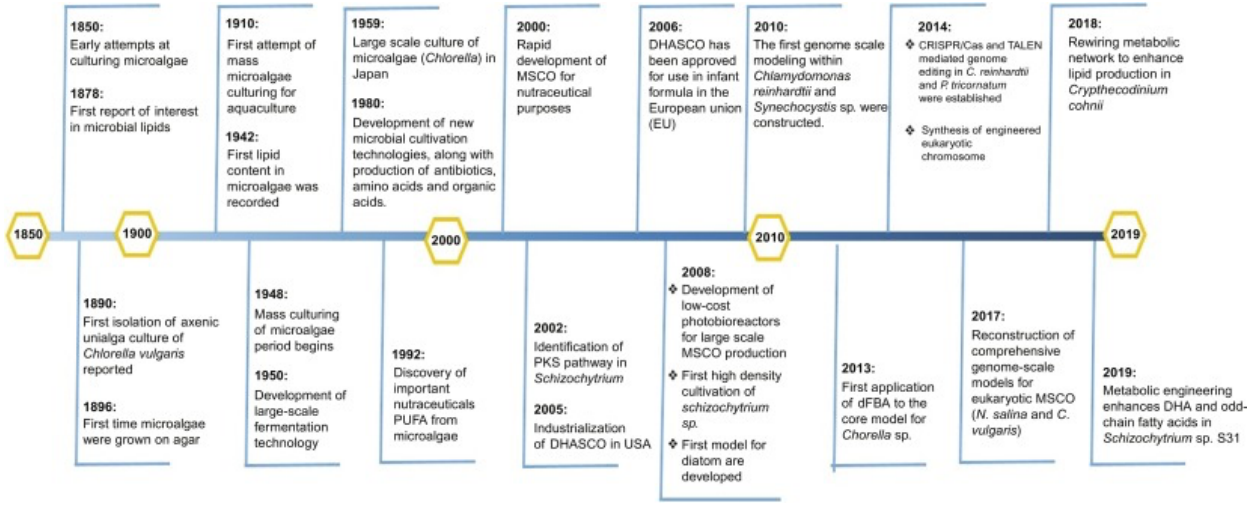
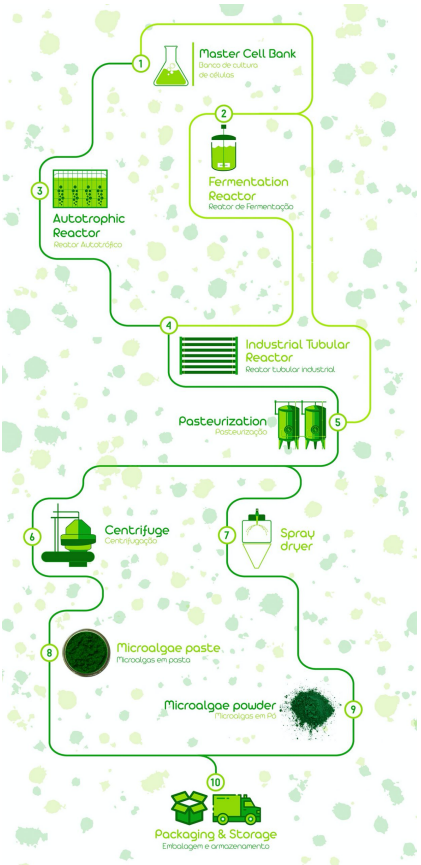
Evolution of microalgae cultivation



New cultivation processes to increase productivity

Heterotrophic production...



The culturing of microalgae in the laboratory is only about 140 years old, and the commercial farming of microalgae less than 60 years. Compare this with the thousands of years history of farming other plants…

Allmicroalgae
natural products

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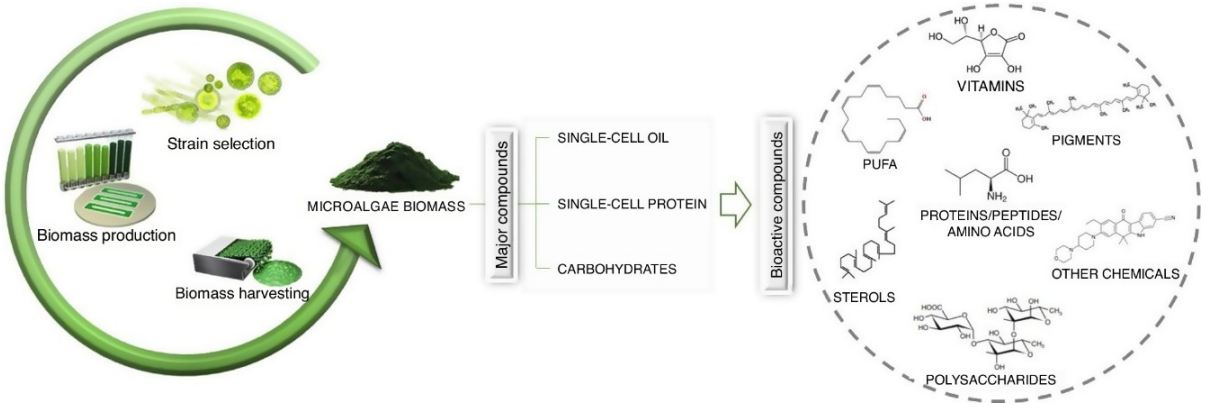
Biorefinery concept



Depending on the species and growing conditions, different added-value products can be obtained.

The integrated vision of the compounds extraction – **biorefinery**, is aligned with the concept of **sustainable production**.

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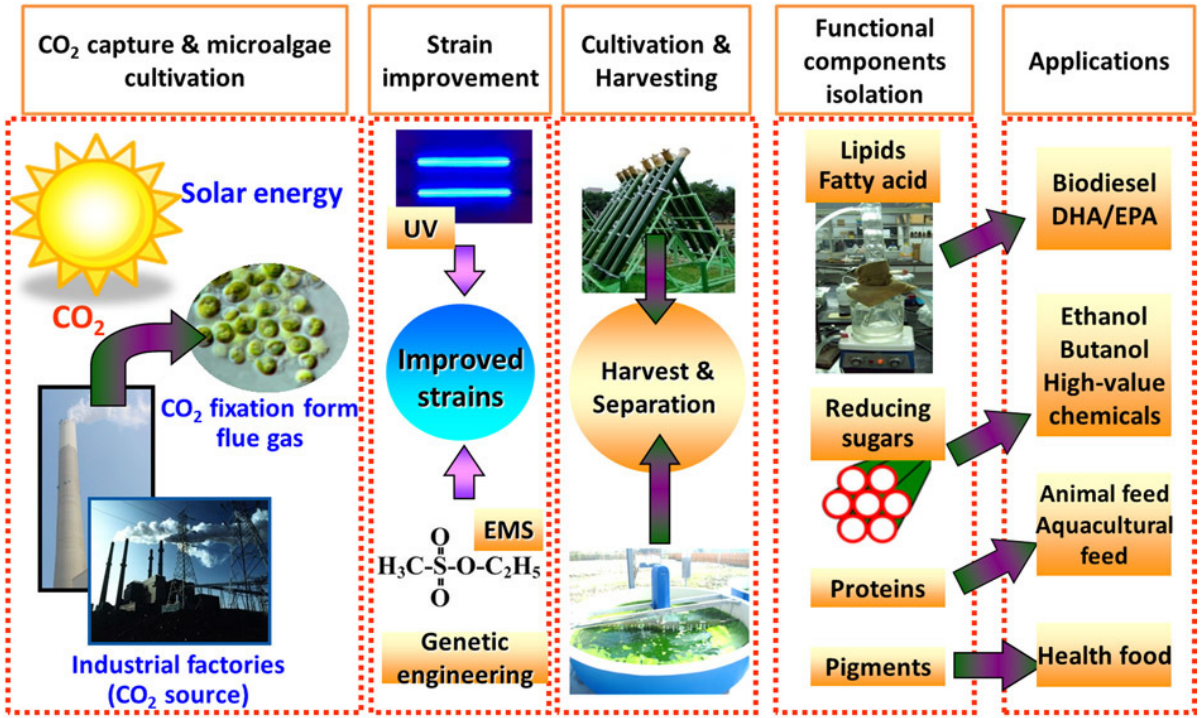

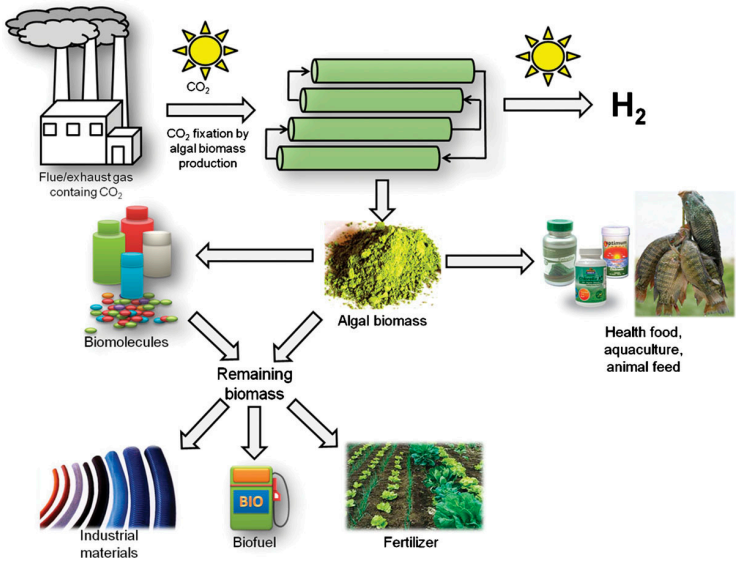

https://www.google.pt/search?q=microalgas%20biorrefinary%20concept&tbm=isch&hl=pt-PT&tbs=rimg:CfcLKyqn9UrxYSj-UfgHBoyX&sa=X&ved=0CBsQuIlBahcKEwjoxuWzv7XvAhUAAAAAHQAAAAAQCg&biw=1389&bih=735#imgrc=_-jtfv-MzsQi3M&imgdii=XwNNnpPUydhJkM

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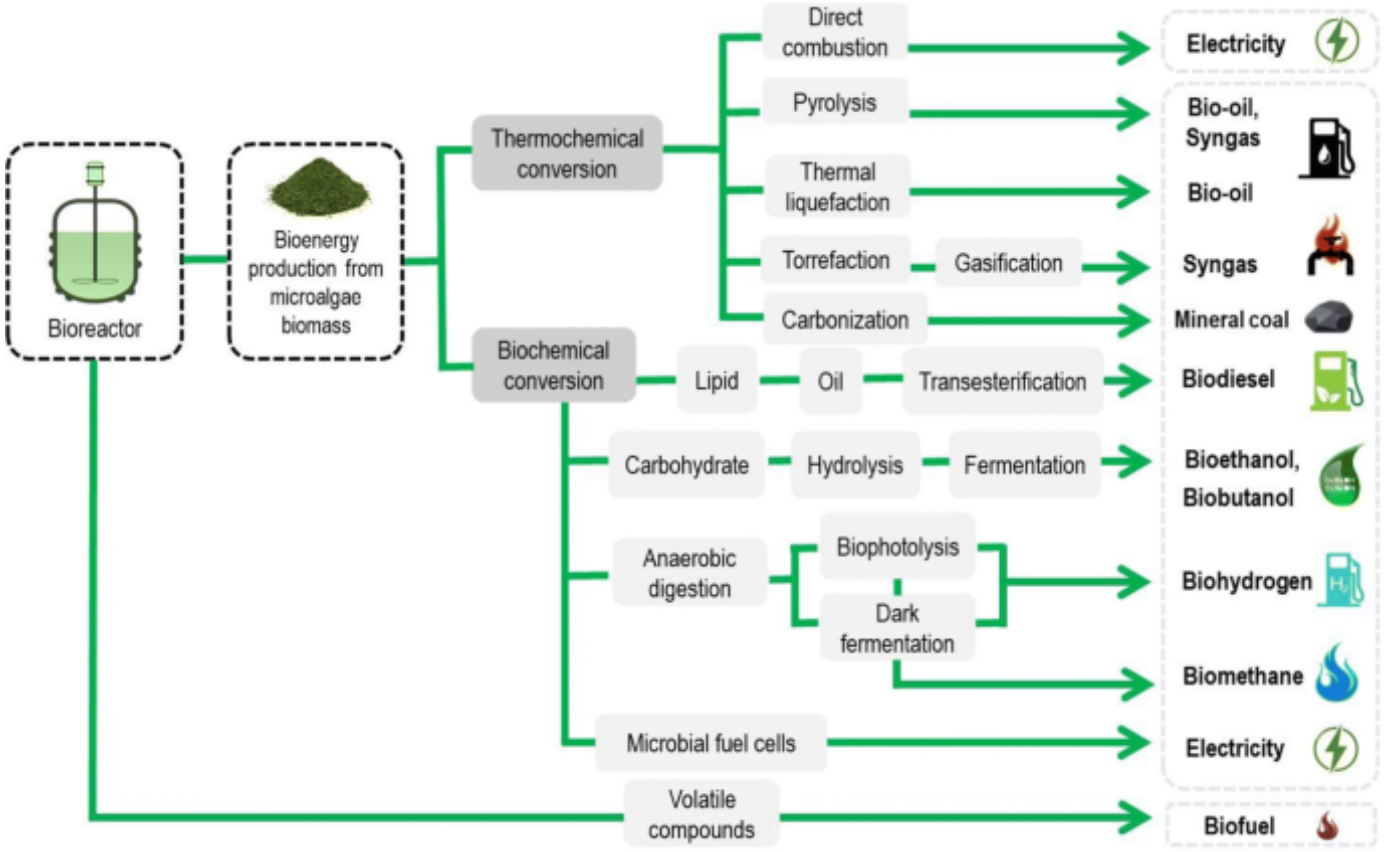

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Benefits of microalgae as an alternative crop

Comparing with traditional agriculture…

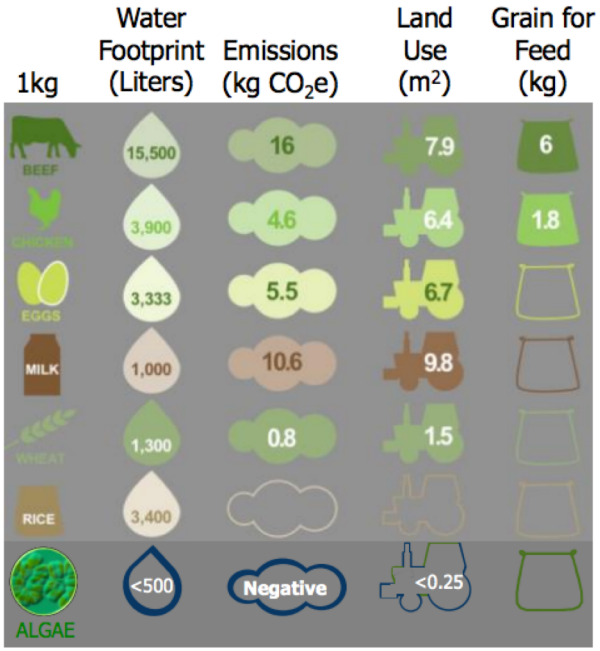
- Increased photosynthetic efficiency
- Higher biomass productivity
- Higher growth rate
- Higher CO_2 fixation (1-3 ton CO_2 / tonne biomass)
- Increased production of O_2
- Use of fresh, salty and brackish water
- Culture medium can be recycled
- Possibility of using degraded soils
- Area of cultivation required for the production of biomass is lower
- Production can be continuous - harvest can be daily

Algae do not compete with any crop, as they can grow on non-arable land and non-potable water

ALGAE BIOMASS ORGANIZATION

Why Algae: Sustainability

Lowest Carbon, Water, & Arable Land Footprints of Any Crop



Sources: Water www.waterfootprint.org/?page=files/productgallery; *emissions and land use UK DEFRA* (2006), http://goo.gl/T12.ho; *grain* National Geographic, http://goo.gl/4CgFB; *Algae*, Cellana estimates

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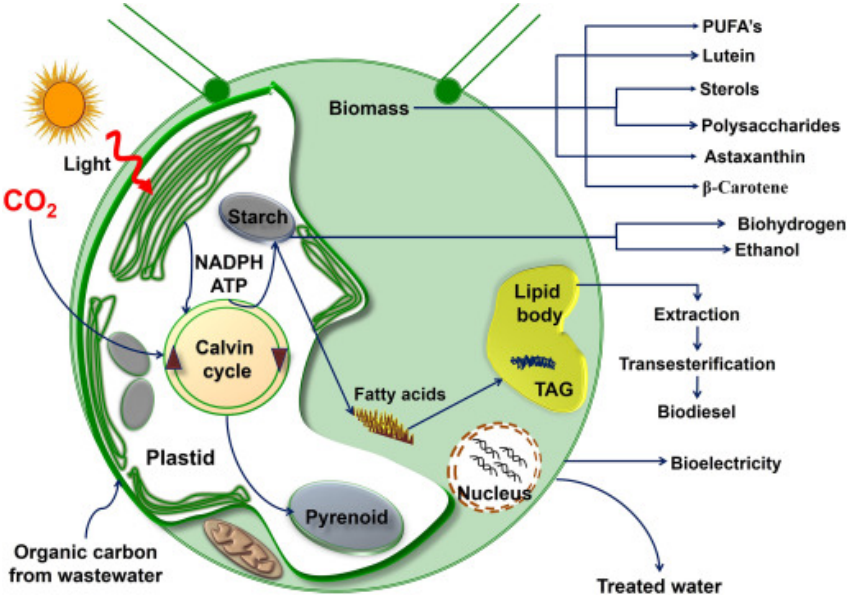
Messages to take home

The production of microalgae has undergone a profound evolution in recent years.

Biotechnology of microalgae allows to obtain biomass with well defined profile and with the possibility of use for the production of several compounds - concept of biorefinery.

The production of microalgae is a sustainable culture, being possible to use it directly, in animal feed, as a food ingredient, cosmetic or to obtain added value compounds.



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