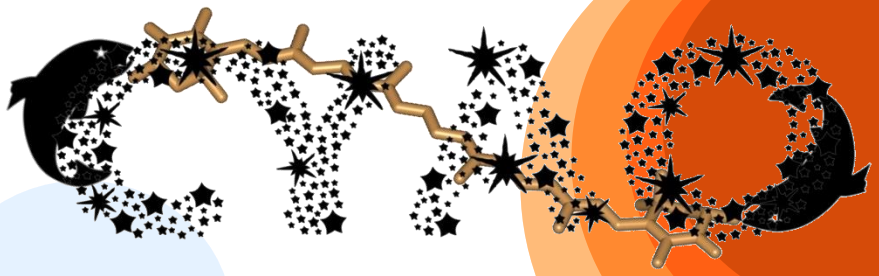

CYAO Project: general introduction. Microalgae & sustainable growth

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Microalgae, what are those?

macroalgae

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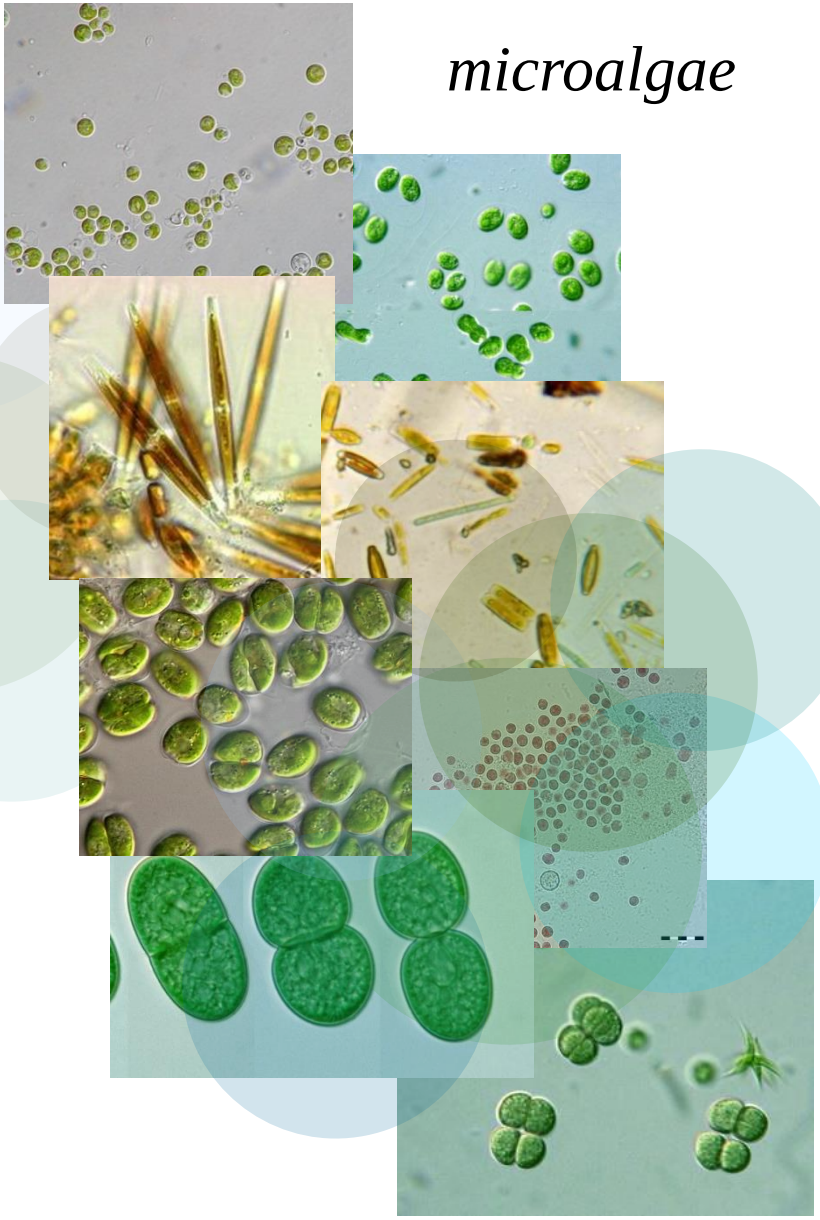
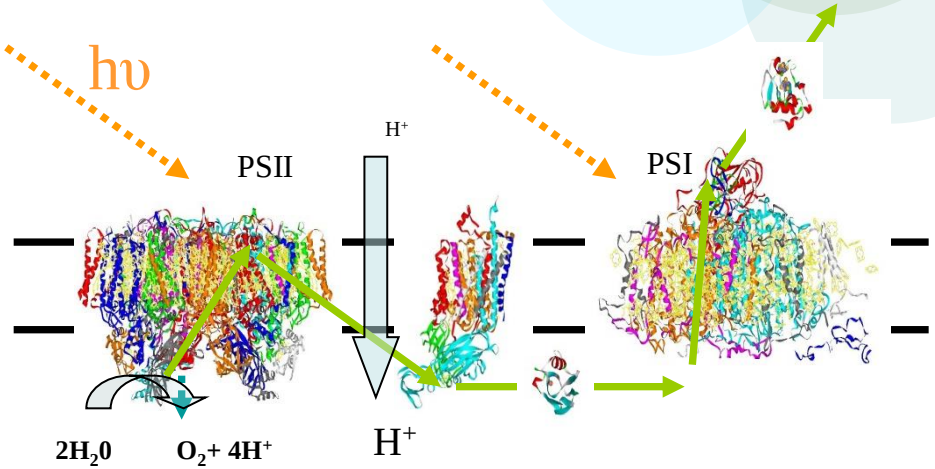
macroalgae

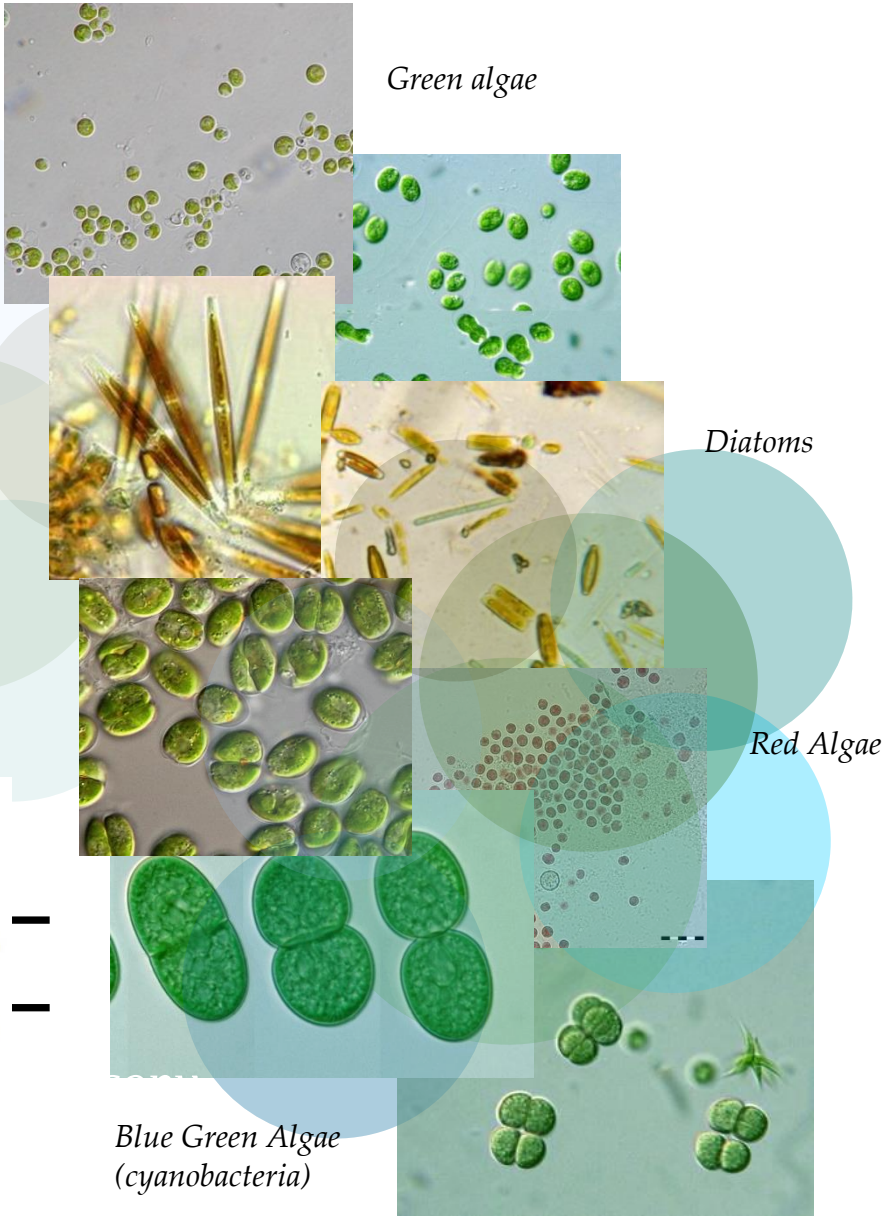


microalgae

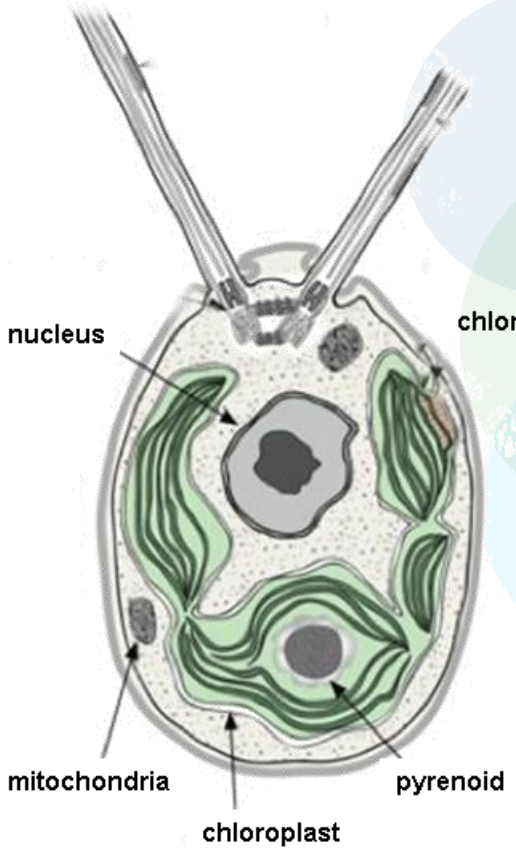
Why micro-algae?

- **Microalgae grow using sunlight (photosynthetic organism)**
- **Sink CO2 from the atmosphere**
- **Can be grown in (semi-artificial) environments called photobioreactors (PBS)**
- **PBS can be installed without competing for agricultural land**
- **Lipids & Sugars composition makes them suitable for biofuel production**

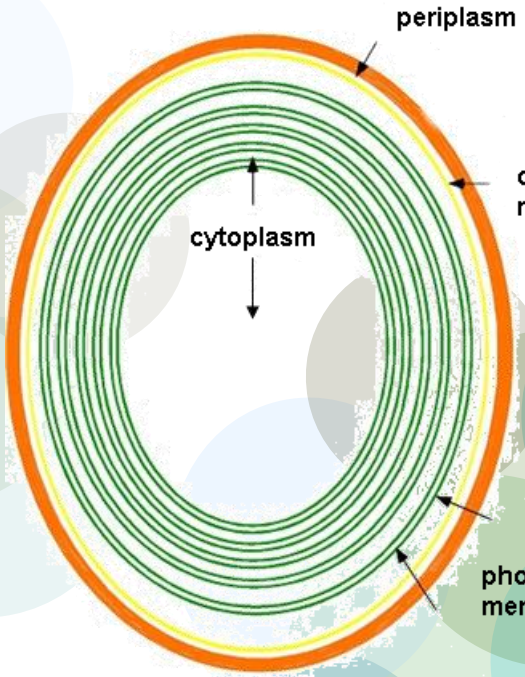




Cyanobacteria, what are those?



a green alga
(C. reinhartii)

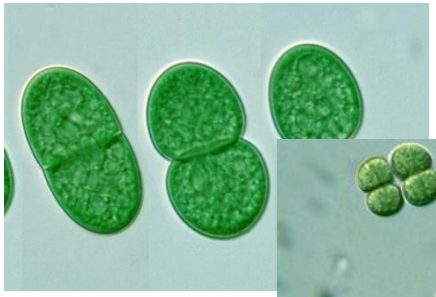


a cyanobacterium

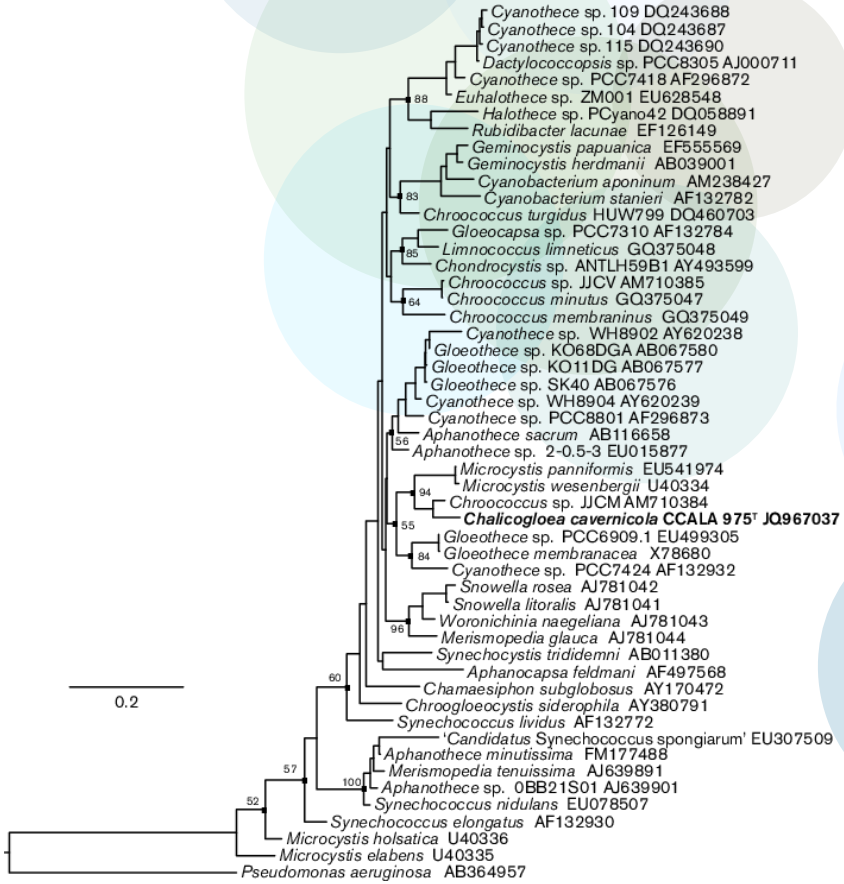
Why cyanobacteria?

- **Plain nutritional requirement**
- **Some can fix N_2**
- **Already well characterized**
- **Showing great diversity**

Synechococcus elongatus PCC7942



Synechocystis sp. PCC6803

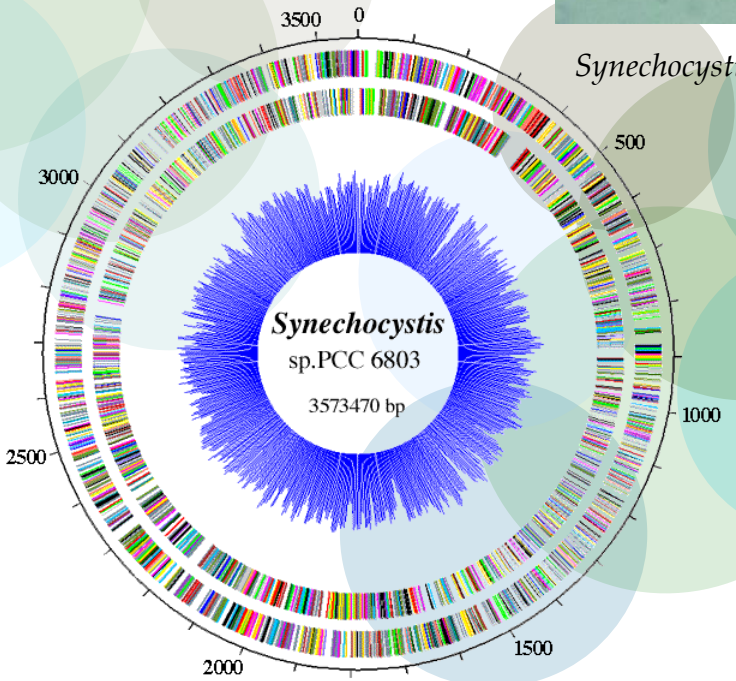


Why cyanobacteria?

- **Plain nutritional requirement**
- **Some can fix N_2**
- **Already well characterized**
- **Showing great diversity**
- **Genome sequenced**
- **Amenable for metabolic engineering**

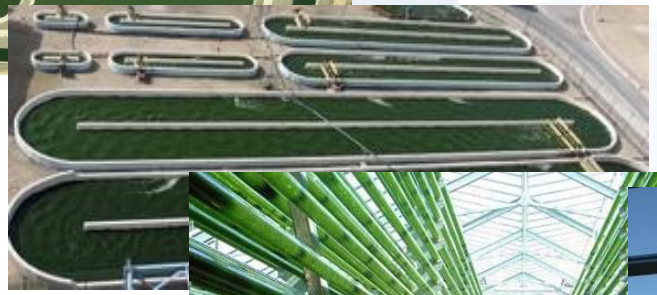
Synechococcus elongatus PCC7942

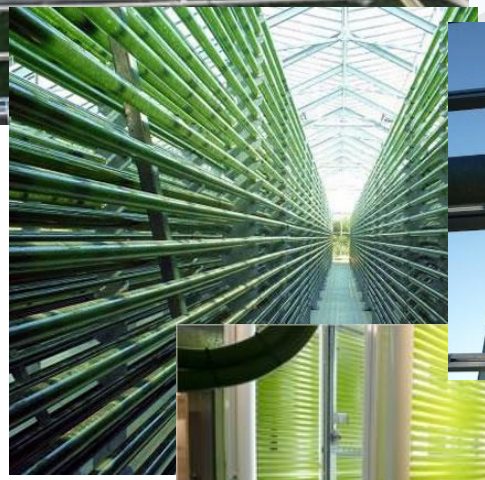
Synechocystis sp. PCC6803



Where?

open ponds





closed systems

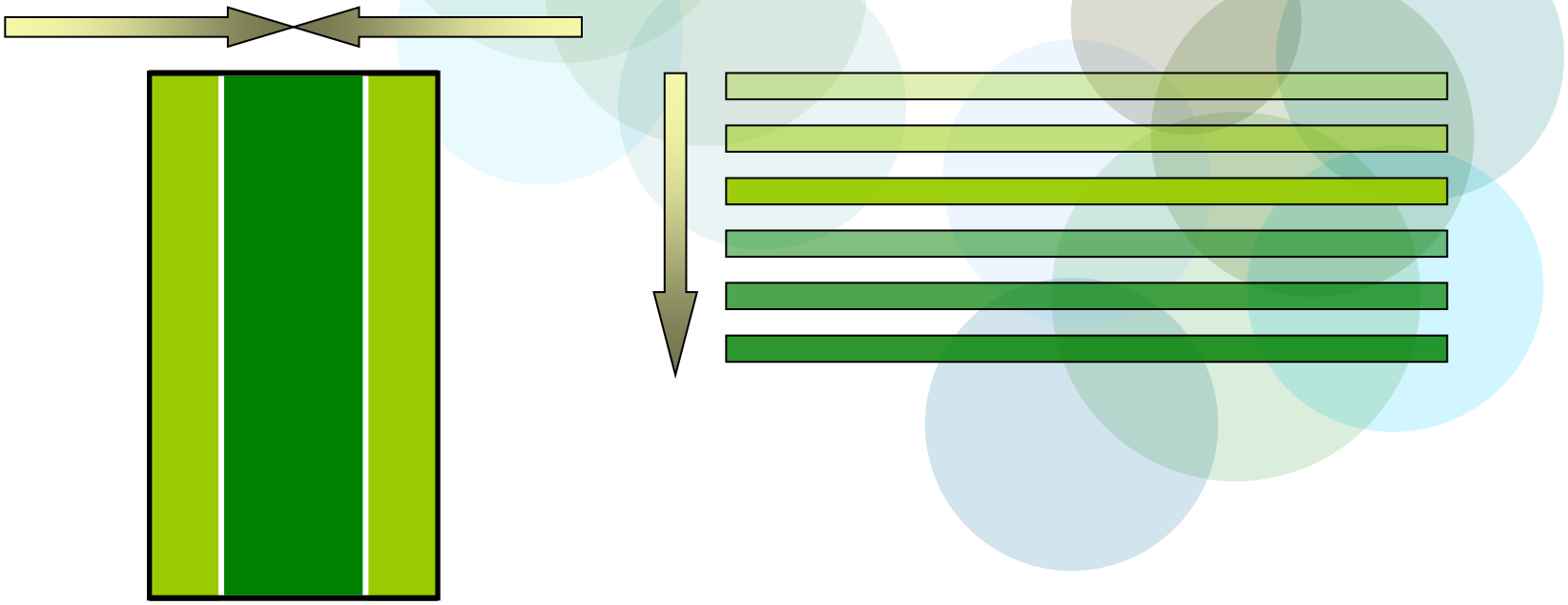
Photobioreactors

Background & Problems:

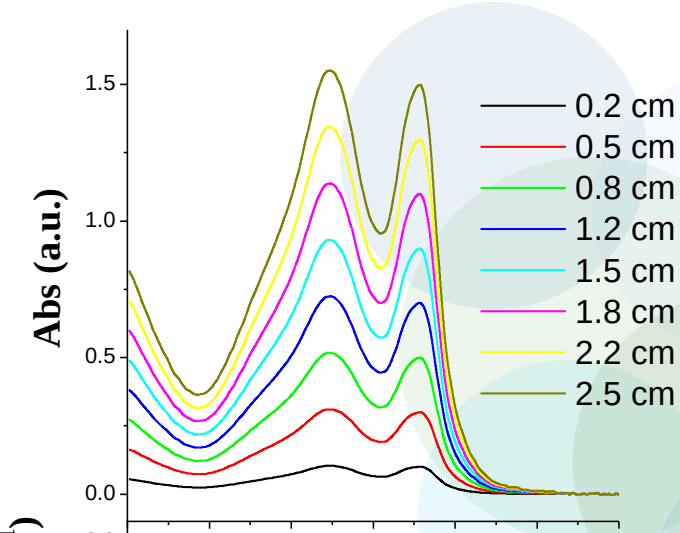
- Bioreactors & Photo-bioreactors (PBR) are foreseen as acquiring increasing importance in sustainable (green) chemistry
- Photo-bioreactors (PBR) are based on the use of phototrophic photosynthetic organisms
- Cyanobacteria are attractive because have plain nutritional requirements and substantial metabolic flexibility
- At present PBR productivity is however lower (than standard bioreactor) and borderline economically fruitful

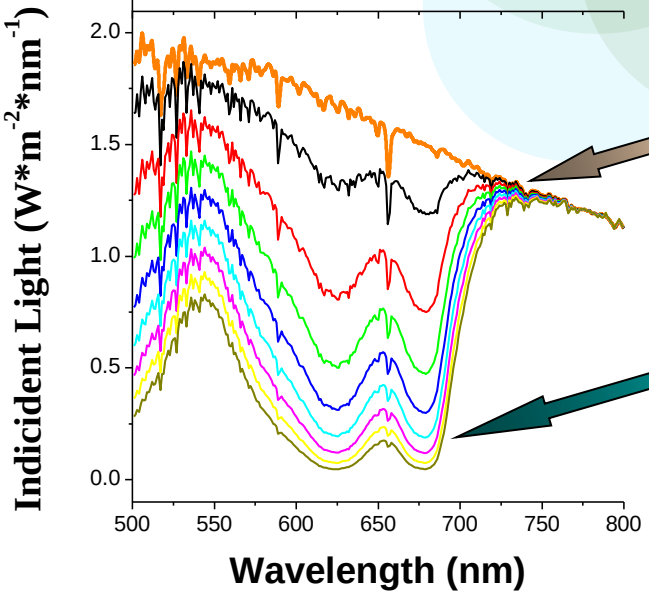
Limit to productivity:

- **Phototrophic photosynthetic use light to grow (rich media are more expensive)**
- **Upon growth light is absorbed by the culture, the inner layers experience a "shaded" environment**



Limit to productivity:





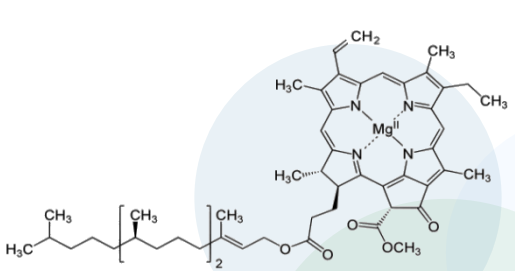
Sunlight

Culture Shaded

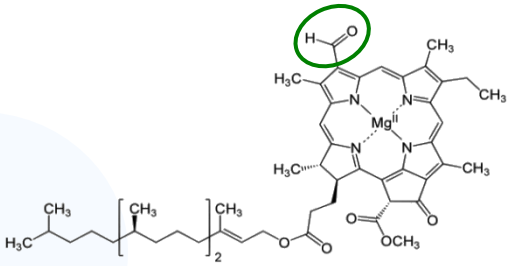
Culture Shaded light:

- **Far Red enriched**
- **Low Intensity (standard)**

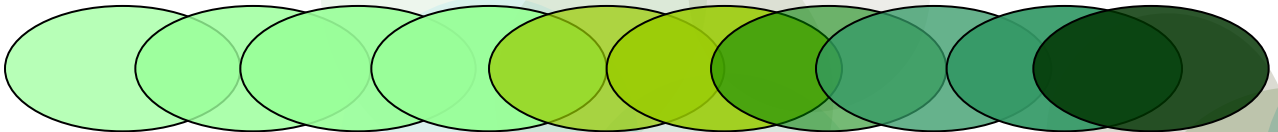
Decrease of productivity limitation:

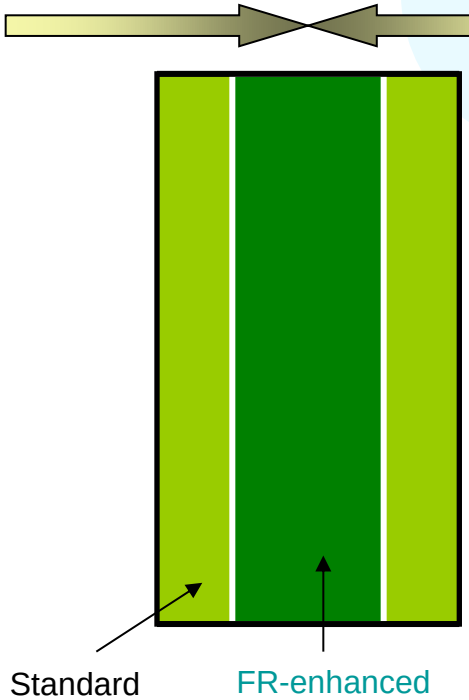


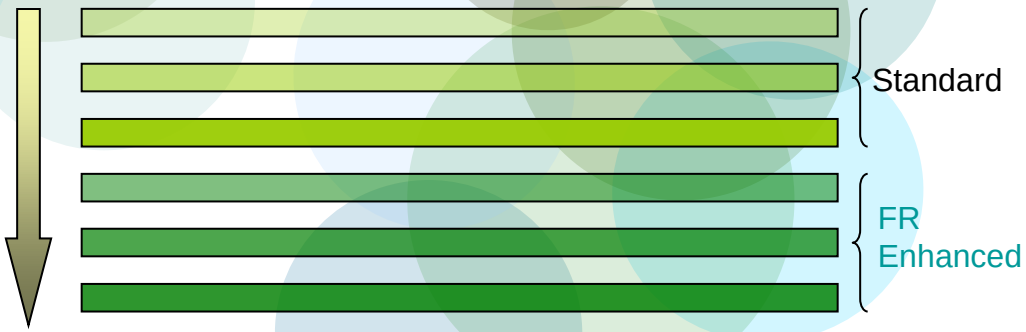
Chlorophyll *a*



Chlorophyll *d*





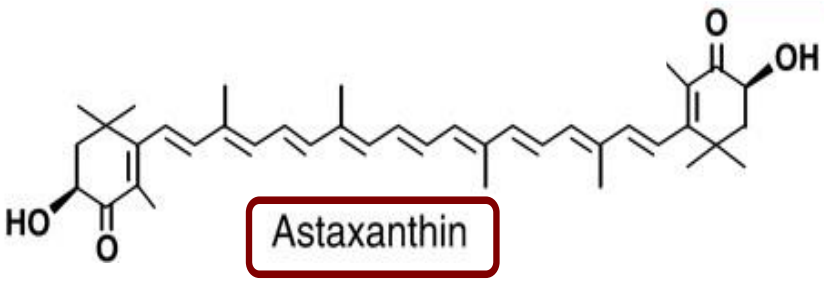


Limit to economic viability:

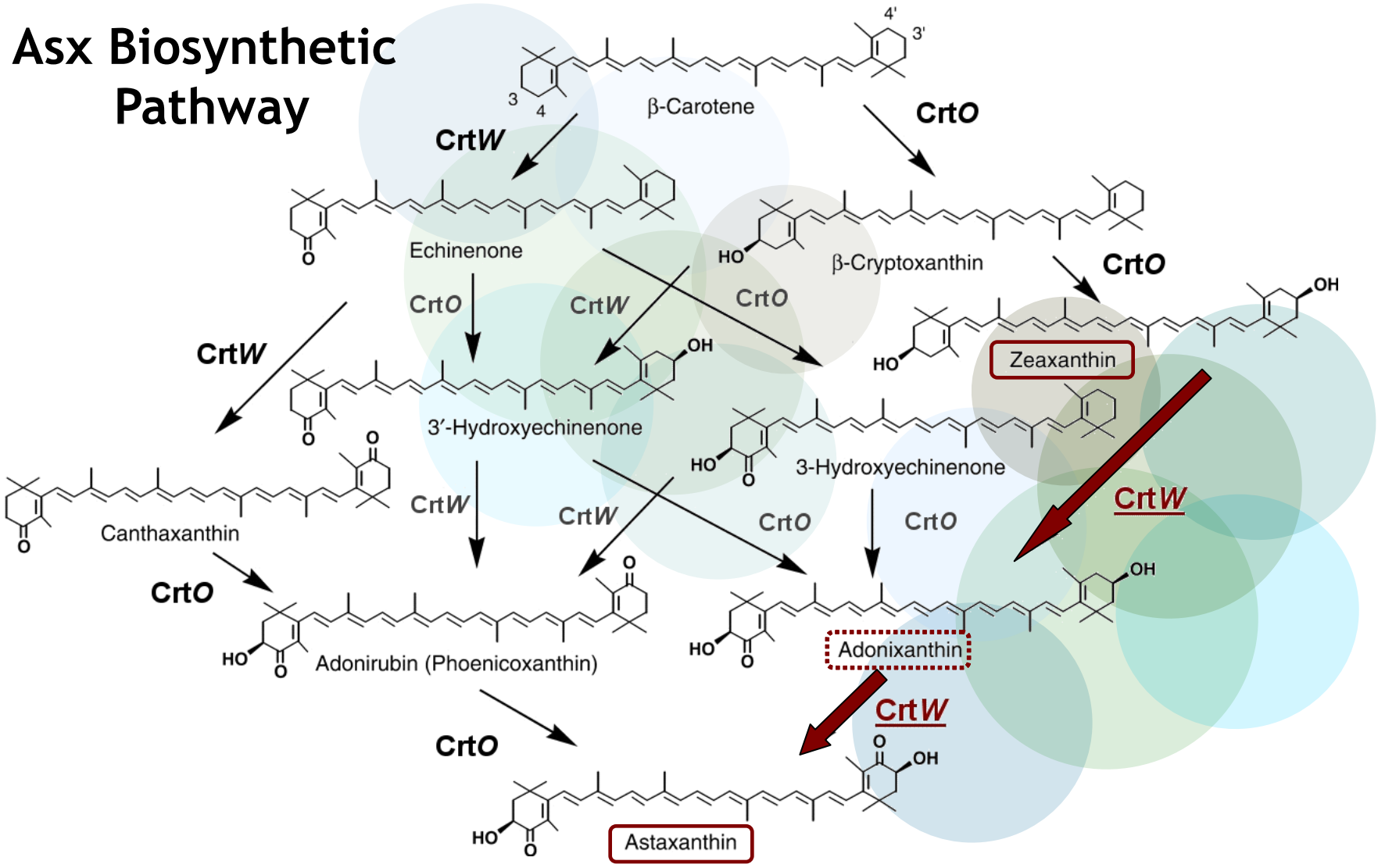
- Even with an efficient PBR the sole biomass for biofuels (ethanol or diesel) has limited economic benefits (but has ecological benefits!)
- Second generation plants: combine biomass + added value bio-products

Limit to economic viability:

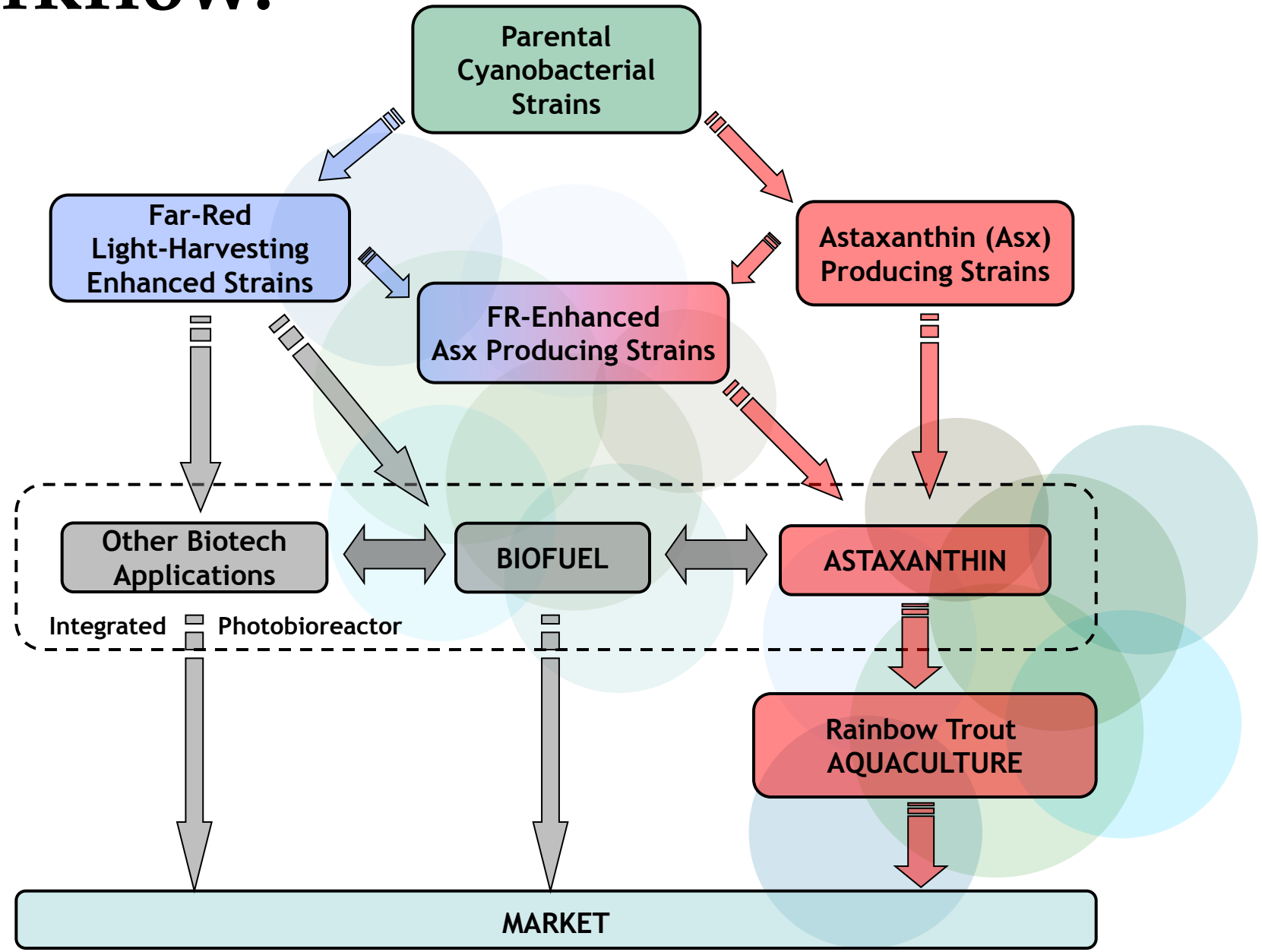
1. Even with an efficient PBR the sole biomass for biofuels (ethanol or diesel) has limited economic benefits (but has ecological benefits!)
2. Second generation plants: combine biomass + added value bio-products
3. The carotenoid Astaxantin (ASX) is the main cost in salmonid aquaculture



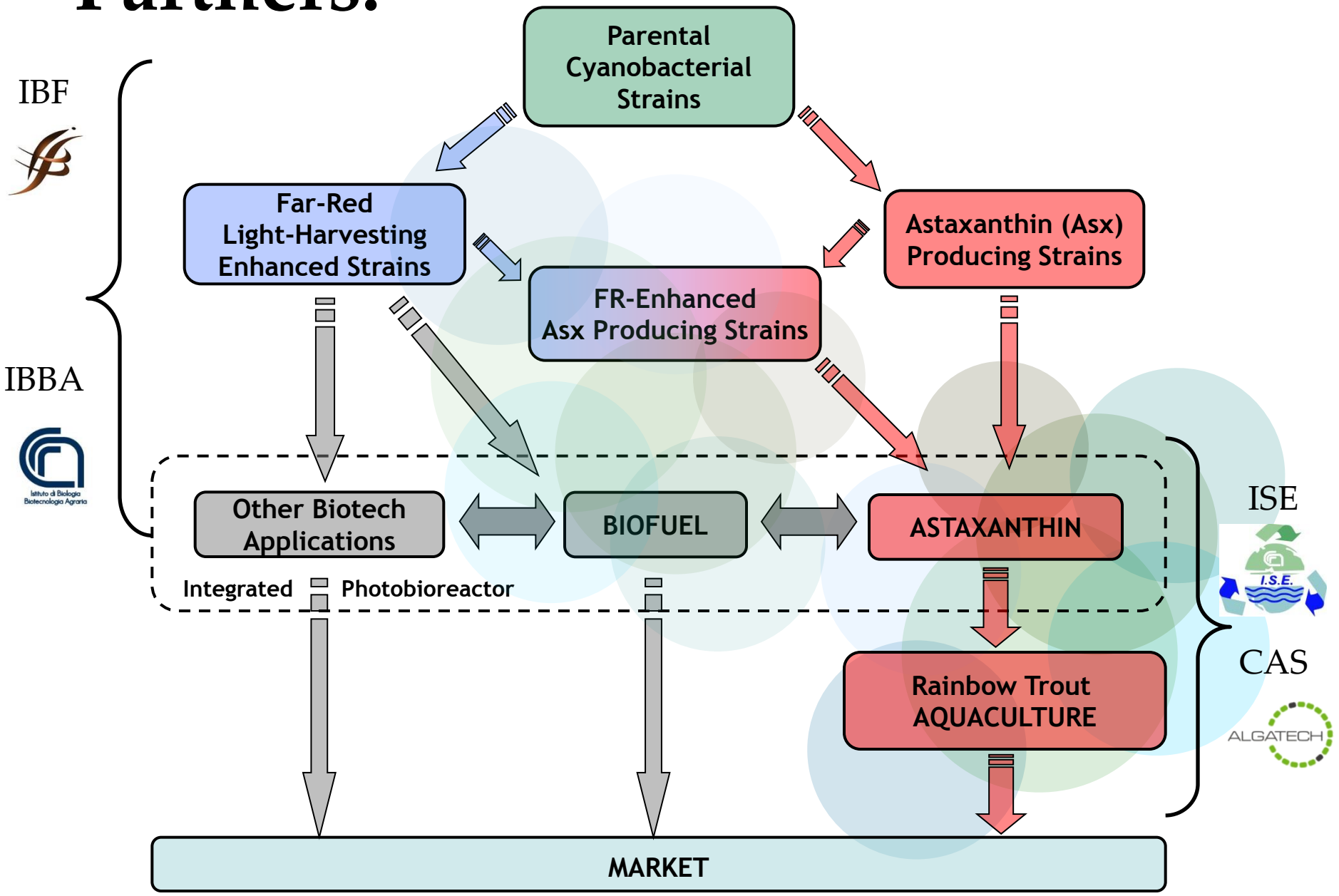
Bypass to economic viability:



Workflow:


Parental Cyanobacterial Strains
Far-Red Light-Harvesting Enhanced Strains
Astaxanthin (Asx) Producing Strains
FR-Enhanced Asx Producing Strains
Other Biotech Applications
BIOFUEL
ASTAXANTHIN
Integrated Photobioreactor
Rainbow Trout AQUACULTURE
MARKET

Partners: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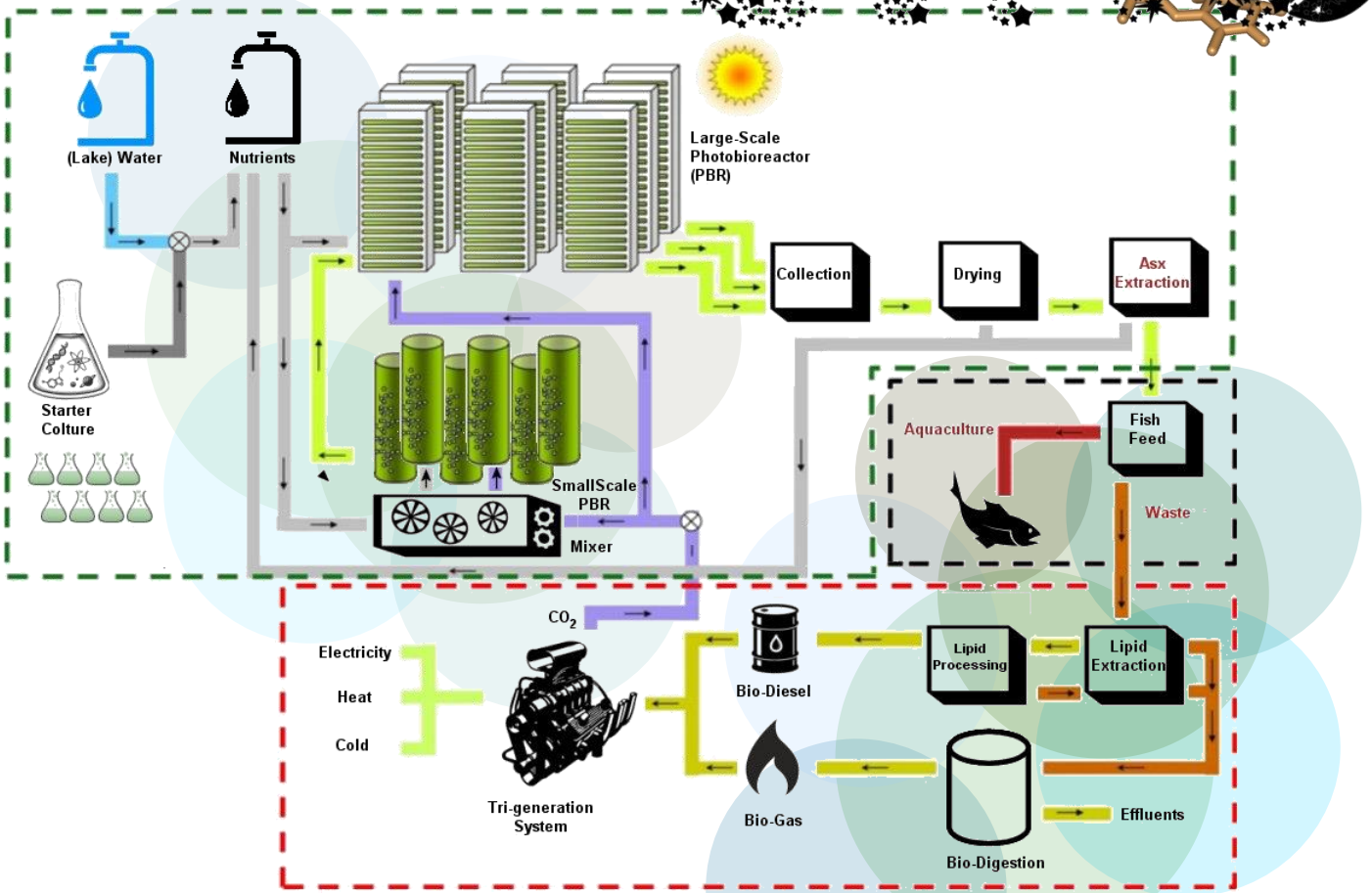
Thank You



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