

On your marks, get set...grow!

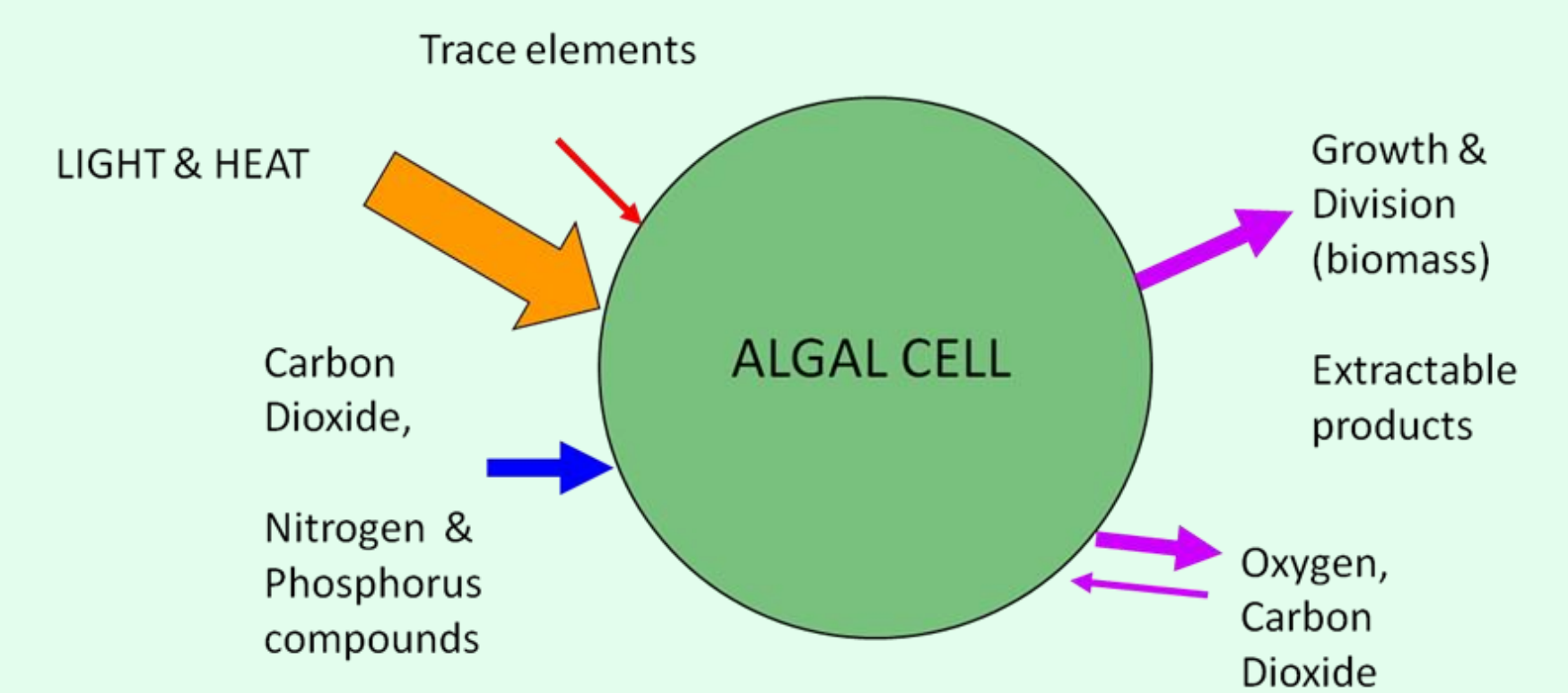
Growing and harvesting algae

Growing for gold

Partly due to their simple structures, algae are highly efficient converters of solar energy, fixing five times more solar energy to chemical energy than most terrestrial plants. As a result they can achieve high

growth rates; some microalgae species can double their biomass in only a few hours.

The principle requirements for growth are light (sunlight or artificial), carbon dioxide, nutrients and trace elements:



Seaweed farming

Although seaweed can be collected simply from the shore, efforts to increase productivity through farming have taken place in the Far East and Europe since the 17th Century.



Traditional methods of cultivation and processing of seaweed in Japan (images courtesy of Prof. Matthew Dring, QUB).

Commonly used substrates on which to grow the algae include ropes (called **longlines**), rings or nets employed in a variety of configurations. These are first 'seeded' with young seaweed **gamaphytes** grown in on-shore hatcheries and then deployed off-shore, supported by networks or stakes or suspended beneath floats.

Depending on the species, the seaweed is left to grow for months to a year, before it is harvested manually or by using specially modified barges.

Incubation; growing-on; and seeding a longline with young seaweed (gamaphytes)...



...a mature longline with a good crop of Laminaria digitata; and manual and mechanical harvesting approaches from seaweed farms in Ireland and New Zealand. (Photos courtesy of NUIG, CEVA, SAMS)

Cultivation & harvesting of microalgae

Microalgae have been cultivated on an industrial scale for decades, most typically grown in **open ponds** or **raceways** for human and animal nutrition. With the desire to produce more specific products, closed photobioreactor (PBR) systems have become increasingly common.

Open ponds/raceways:

Open ponds could be simple lakes to engineered oval raceways, filled with saltwater or freshwater to which nutrients are added.

Benefits: Simple; low cost; high volume.

Drawbacks: Limited by ambient light and temperature; require land; vulnerable to predation and/or invasion by unwanted algae species.



Open raceway at an algal demonstration facility, Hawaii (<http://cellana.com>)

Closed Photobioreactor Systems (PBRs):

These systems are flexible in design and could be transparent tubes, panels, bags in a range of configurations. They can be intricately engineered or very simple. Cultivation in closed PBRs enables greater environmental control resulting in predictable and reproducible growths of high density microalgal cultures.

Benefits: High productivity per unit area; no contamination.

Drawbacks: Relatively complex/expensive; high energy use if artificially lit or temperature controlled.

See our PBR demonstration for more information!

Harvesting

Once optimum concentrations of microalgae are reached, the PBR is drained and the algae are separated from the liquid media until a thicker algal paste is obtained. Dewatering techniques include **settling or flocculation**, **centrifugation** and **micro-filtration**.

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