ERC Starting Grant – BiOLEAP Biotechnological optimization of light use efficiency in algae photobioreactors

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New renewable energy source are highly needed to compensate exhausting fossil fuels reserves and reduce greenhouse gases emissions. Some species of algae have an interesting potential as feedstock for the production of biodiesel thanks to their ability to accumulate large amount of lipids. Strong research efforts are however needed to fulfil this potential and address many issues involving optimization of cultivation systems, biomass harvesting and algae genetic improvement. This proposal aims to address one of these issues, the optimization of algae light use efficiency. Light, in fact, provides the energy supporting algae growth and must be exploited with the highest possible efficiency to achieve sufficient productivity and make their cultivation competitive.

Algae efficiency in converting solar radiation, however, depends on many environmental factors, including light intensity, temperature, nutrient and CO2 availability. Optimizing microalgae productivity in such a complex environment hinges on our ability to describe, in a quantitative manner, the effect of these various parameters as well as their mutual interactions. Application of computational models that are capable of quantitative predictions can prove especially useful in identifying which parameters have the largest impact on productivity, thereby providing a means for enhancing growth through design and operational changes.

Conditions found in a photobioreactor are different from the ones cells are evolutionary adapted to. *Nannochloropsis gaditana* with altered regulation of photosynthesis has been isolated and showed improved productivity in lab scale photobioreactors.

Light influence on algae metabolism has also been investigated using a combination of genomic, transcriptomic and metabolomics analyses. These evidenced how light availability in *Nannochloropsis gaditana* modulates the carbon partitioning and TAG biosynthesis by affecting the transport of reduced carbon in and out of the chloroplast.