Chapter 17
Concluding Remarks

Abstract Aquatic photosynthesis provides for a largely unexplored organic carbon feedstock and, although in infancy, its exploitation could represent a substantial contribution to renewable energy.

Keywords Aquatic photosynthesis • Biofuel • Domestication

There is no one solution to the problem of developing bioenergy resources to sustain our demands, and a single biofuel, as efficient as it may be, would be insufficient in the long term and on a global level. In this perspective, exploration of novel and alternative feedstocks and technologies becomes necessary. Aquatic photosynthetic organisms account for a great fraction of global organic carbon on Earth, representing a largely unexplored feedstock compared to land plants and crops. Algae and cyanobacteria perform oxygenic photosynthesis, where light drives assimilation of CO_2 into organic carbon. Carbon in excess of that required for respiration and other metabolic activities is accumulated as biomass, a form of stored chemical energy. Several biofuels could be obtained, from the metabolism of the living organism or from the processing of the biomass.

Exploitation of algae and cyanobacteria for the production of biofuels is still in its infancy. Crops, that also convert solar energy into chemical energy, are being exploited for the production of biofuels since decades and dominate the biofuel industry. However, crops are domesticated varieties, while algae that are cultivated for high-value products are mostly undomesticated and would require genetic improvement before being used for the production of cheap energy carriers. This may justify the delay in algae contribution to the biofuel industry. Moreover, while prospects of further improvement in higher plants are less favourable, because current cultivated crops have been already genetically improved and cultivation techniques are well optimised, it is conceivable that substantial improvements in algae cultivation could be achieved in the future, upon domestication of wild-type strains and optimization of the cultivation systems.

C. Formighieri, *Solar-to-fuel conversion in algae and cyanobacteria*,
SpringerBriefs in Environmental Science, DOI 10.1007/978-3-319-16730-5_17