

Preface

In recent years, the use of microalgae as phototrophic microorganisms capable of sustainably converting sunlight and CO₂ into energy-rich and valuable products became an innovative research area of increasing interest. Microalgae are known to efficiently use the process of water-splitting photosynthesis for the conversion of solar energy into useful chemical energy. They are therefore considered as excellent candidates for the production of biofuels and biopolymers, thus replacing or complementing production processes with heterotrophic microorganisms or traditional crops. The solar-powered synthesis of sustainable products directly from CO₂, water and sunlight with microalgae has the potential to provide a renewable source of fuels and high-value commodity chemicals whilst helping to mitigate climate change and is therefore of economic and environmental priority for the public. However, biotechnology driven research with microalgae is still in its infancy. Improvements are required for the molecular processes of sun-to-product conversion as well as for the development of efficient and profitable biomass production systems with positive energy balances. To reach these goals, state-of-the-art research in algae biotechnology projects include a wide range of activities ranging from fundamental approaches, such as screening for suitable algae species or performing systems biology for the identification of potential bottlenecks of production processes, to more applied approaches like the development of crucial technologies for genetic and bioprocess engineering. As an essential add-on, detailed life cycle analyses are widely performed embedded into theoretical and practical feasibility studies to ensure that sustainable bio-refineries with microalgae can be achieved in the future.

This book covers a wide range of these exciting developments in the area of algae biotechnology and guides the reader through different aspects of molecular biology and biochemistry research, process development, case studies and life cycle analyses performed by academia but also by spin-up companies. The first two sections – collected in the present volume – focus on the biological potential microalgae can provide and on technical means of algae production. The idea for this book arose from several communities: the microalgae working group of the “DECHEMA”, the collaborative algae research group of the EU-FP7-KBBE “SUNBIOPATH” project and the international “SOLARBIOFUELS” consortium (www.solarbiofuels.org). Members of these groups felt the need to have an updated comprehensive book on modern microalgal biotechnology and decided to activate their personal worldwide networks to contribute. I am delighted that the book has now been published in such an attractive format that a good reception by the readers can be expected and I am sure that this book can provide a valuable guideline for future microalgal biotechnology discussions.

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