# Foreword

The biological conversion of carbon dioxide to organic compounds has emerged as a key chemical process of the planet Earth and led to the extant proliferation of life forms. This process is mainly driven by solar energy and, as photosynthesis, it is practiced by organismal forms called photoautotrophs. Algae and plants are the most commonly observed photoautotrophs both in terrestrial and aquatic habitats, and they usually appear as independent organisms. Nonetheless, the algal lifestyle is a bacterial invention. Cyanobacteria are the original photoautotrophs which started the oxygenic revolution about 2.5 billion years ago. According to the endosymbiotic theory, eukaryotic cells have taken up cyanobacteria to adopt the algal principle of life as well. While algae diversified as several main lineages of eukaryotic diversity, all plants originated within only one of these (Charophytes). Algal life forms are ubiquitous in most diverse habitats where they encounter heterotrophic organisms, unable to take benefit from the solar energy. However, heterotrophs are not only feeders and parasites of photoautotrophs. Rather, heterotrophs may live together with photoautotrophs in stable, self-sustained associations. For example, the majority of plant species develop associations at their roots with specific fungi,

a phenomenon that is well known as mycorrhiza, and the diverse aspects of mycorrhizal symbioses are meticulously studied with the finest approaches that are currently available. There is no doubt about the economic significance of mycorrhiza, which, as an important fitness factor also facilitated the evolutionary diversification of plants in general. However, in comparison with plants, the vast diversity of algal symbioses is still less understood. Since access to fixed carbon is secured by association with algae, it is not surprising that algal symbioses are likewise common.

In this book, we provide an overview of the recent state of knowledge about algal symbioses from diverse perspectives and case examples. We regard algae as life forms rather than as a phylogenetic group, and besides eukaryotic lineages, we include cyanobacteria, as well as a chapter on plastid gain by endosymbiosis. The state of research is clearly varying in the different branches of algal symbiosis research. We thus include chapters which primarily focused on more general assessments of biodiversity in algal symbioses, in addition to those which review the more recent ecological/physiological insights, present more specific case examples, or little-known topics such as the associations with animals, or the biosynthetic potential of cyanobacteria. With this compilation, we want to raise more interest in these fascinating cases of cooperation in nature, which demonstrate the high evolutionary potential of symbioses.

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