

# Preface

The brief is very topical as its theme “carbon concentrating mechanism of photosynthetic microorganism” impacts on the lives of all of us. World’s rapid industrialization has led to severe interlinked global environmental challenges, such as energy crisis, pollution, and global warming. It is widely recognized that fossil fuel combustion and other emissions resulting from anthrop activity, produces greenhouse gases in which carbon dioxide ( $\text{CO}_2$ ) is the biggest contributor by volume (76 % of  $\text{CO}_2$  emissions from Fuel Combustion (2012), International Energy Agency). It has been implicated in the global climate change, and reducing them is a potential solution. In this regard, we must consider photosynthetic microorganism-based carbon mitigation system with the most efficient photosynthetic pathways to reduce the excess atmospheric  $\text{CO}_2$  concentrations. The use of such technology will result in balanced  $\text{O}_2$  and  $\text{CO}_2$  concentrations to mitigate global warming, avoid dangerous climate change, and reduce toxic levels of atmospheric  $\text{CO}_2$  through transformation into other forms of carbon. Photosynthetic microorganism such as cyanobacteria and microalgae acquired a special mechanism called “carbon concentrating mechanism (CCM),” which induced in limiting  $\text{CO}_2$  environment and increases the  $\text{CO}_2$  concentrations actively in the proximity of RuBisCO. Due to the action of CCM, photosynthetic microorganisms have high photosynthetic efficiency than terrestrial  $\text{C}_3$  and  $\text{C}_4$  plants. CCM is by far the most spectacular physiological process in algal growth and productivity. Due to this fact, the study of CCM has captivated algologist, algae physiologists, algal molecular and cellular biologists, botanists, agriculturalists, crop growers, and most recently algal biofuel researchers around the world. From an esthetic perspective, I thought that it would be wonderful to include many of the remarkable findings on CCM of both important photosynthetic microorganisms in a single inclusive volume.

Book begins with an introduction to the topic, and follows with the reviews on modern carbon sequestration options and proposed measures to stabilize atmospheric  $\text{CO}_2$ . It then provides state-of-the-art information on CCM of photosynthetic microorganism, as well as also emphasizing its integration with different industry. It helps readers to understand better the interconnection between photosynthesis and CCM and its potential impact on global climate change. This

multi-authoritative work by experts also gives insights of metabolic pathways of photosynthetic microorganism, needed to engineer the metabolic pathways of photosynthetic microorganism for enhanced CO<sub>2</sub> fixation. Brief addresses the needs of energy researchers, chemical engineers, fuel and environmental engineers, post-graduate and advanced undergraduate students, and others interested in sustainable energy and environment development. It is also very helpful for Entrepreneurs and Companies planning to start a venture in algae-related industries or businesses with synergistic operations exploring fuel from algae ventures. Brief is highly useful and helps to plan new research and design new economically sustainable viable processes for the production of clean fuels and value added products from algae. Thus, the overall goal of brief is to provide in-depth scientific details on the basic and applied aspects of CCM of both important photosynthetic microorganisms (microalgae and cyanobacteria). Many figures and tables are included in the brief to facilitate understanding and comprehension of the information presented throughout the text. Hundreds of references have been used to prepare this unique collection. The authors welcome reader's comments and suggestions, especially any drawing our attention to errors in the text. The readers can sent their comments and suggestions directly to me by e-mail at [shailbiochem@gmail.com](mailto:shailbiochem@gmail.com).

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Mechanism For Carbon Concentration

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