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Paradigm shift of primary producers of the Oceans

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Phototrophs carry out the light-induced electron flow, and synthesize organic compounds using the resulted proton-electrochemical potential gradient across the membrane. Ecosystem depends its energy on the organic compounds produced by phototrophs. The phototrophs are, therefore, the starting point of energy flow into the ecosystem. Marine ecosystem takes about a half of global primary production accounting for ca. 50 gigatons of carbon per year. For a long time, it was believed that diatom and flagellated phytoplankton were responsible for the marine primary production. However, recent improvements and developments of HPLC detection technique for photosynthetic pigments, molecular detection technique for microbes, flowcytometry, metagenome analysis and so on revealed following discoveries;

1) Picocyanobacteria including Synechococcus and Prochlorococcus are widely and significantly distribute over the ocean surface (1-3).
2) Bacteriochlorophyll a-containing aerobic anoxygenic photosynthetic bacteria are widely and significantly distribute over the ocean surface (4).
3) Proteorhodopsin-containing bacteria are widely and significantly distribute over the ocean surface (5).
4) Eukaryotic picophytoplankton are widely and significantly distribute over the ocean surface (6,7).
5) Diverse of chlorophylls could be detected in the sediment core samples (8).

These discoveries suggest that the starting point of energy flow in the marine ecosystem is not only the microalgae such as diatom and flagellated phytoplankton but also diverse phototrophs.
In this presentation, I would like to discuss the paradigm shift of the understanding of marine primary producers which had been treated as black box.

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