

Photosynthesis: Synthesis of what?

M. M. Gunawardane

Department of Microbiology, Faculty of Science, University of Kelaniya, Sri Lanka
mahendra@kln.ac.lk

The term photosynthesis is often used to mean the entire chain of biochemical reactions, which is initiated by light and concluded by the synthesis of carbohydrates. This series of reactions has two clearly distinct stages. First, there is the synthesis of ATP and reduced coenzymes (e.g. NADPH) with the help of light energy. Next, ATP and a reduced coenzyme are used in the synthesis of carbohydrates (e.g. starch) from CO₂. As the first stage involves light, it is known as the light reaction of photosynthesis, while the second stage, which does not require light, is known as the dark reaction of photosynthesis.

The dark reaction in nature is not a process necessarily dependent on a photo-mediated activity, the light reaction. What dark reaction needs for the reduction of CO₂ into organic carbon is a reduced coenzyme and ATP, and the source of those compounds does not necessarily have to be the light reaction. This review proposes that the dark reaction should not be described as part of photosynthesis.

Dark reaction is not a process limited to organisms that use photo energy to produce ATP and reduced coenzymes. In fact, without any dependence on photo energy, it happens in nature in some non-photosynthetic chemotrophic organisms as well. Thus, the light reaction is not an essential precondition for the dark reaction. Furthermore, ATP and reduced coenzymes synthesized by the light reaction in nature are not entirely used for the dark reaction. As such, the light reaction is not an activity that leads only to the dark reaction.

Since the dark reaction can occur independently from any photo-driven synthesis process, it should not be described as part of photosynthesis. Therefore, the term photosynthesis should be confined to describe only the light reaction, defining photosynthesis as the process in nature that synthesizes ATP and reduced coenzymes using light energy.

Dark reaction, which describes fixation of CO₂ in to organic compounds, is an activity carried out by photosynthetic organisms and certain chemolithotrophic bacteria as well. It can be appropriately described by the term autotrophy, defining it as the primary production of carbohydrates in the biosphere.

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