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**Reading**

PDF (OpenStax)

8.3 Carbon Fixation (OpenStax CNX)

**Learning Outcomes**

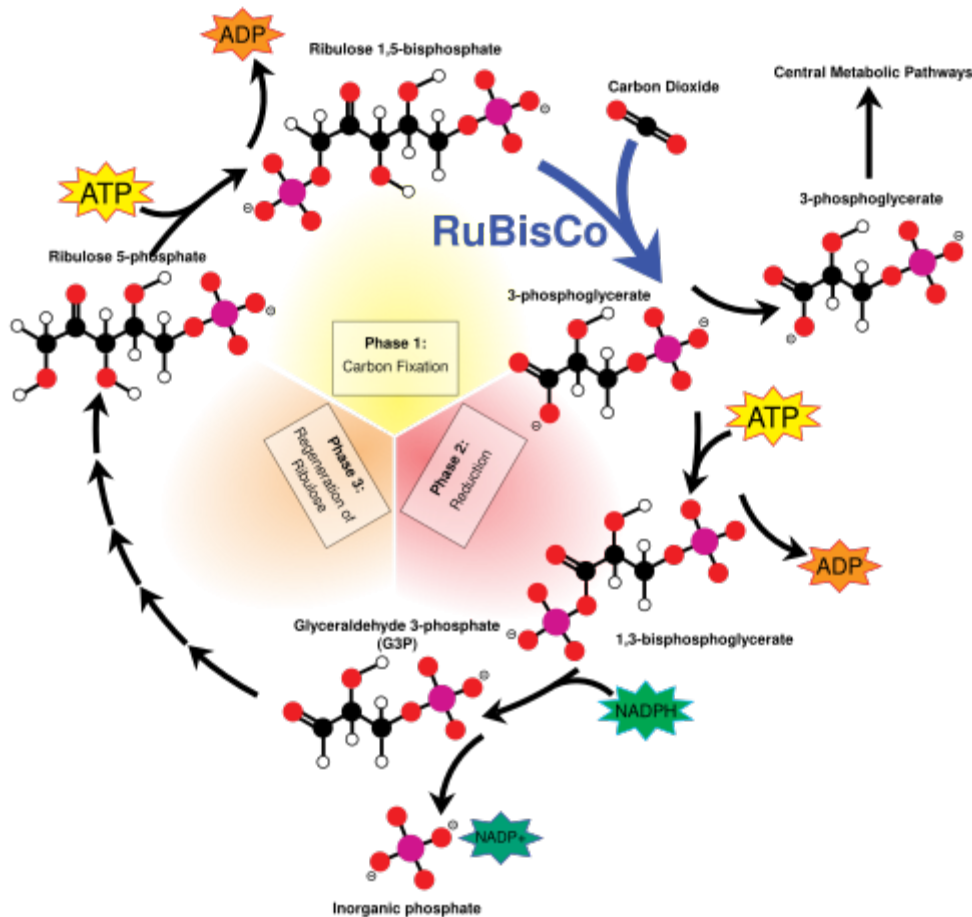
Discuss the main events that occur in the Calvin-Bensen cycle, and tell the cycle must turn six times in order to generate a 6-carbon sugar.

Explain the process of photo respiration, and describe the environmental conditions that favor this process.

Discuss the C4 and CAM pathways; explain why C4 plants photosynthesize more efficiently than C3 plants.

Describe the global carbon cycle.

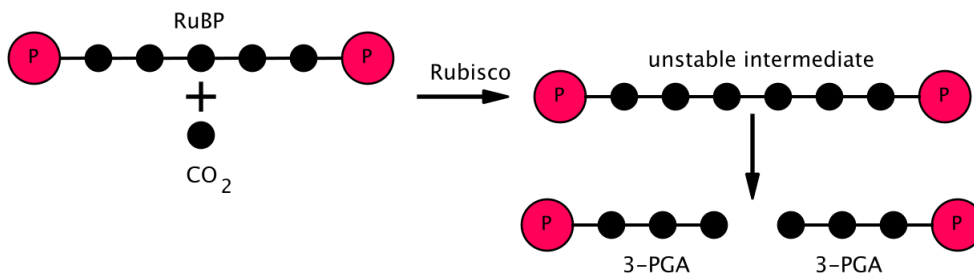
**Light Independent Reactions**



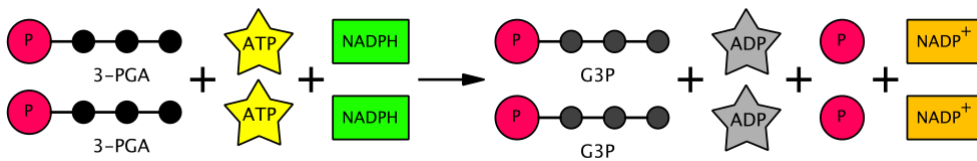
Credit: Mike Jones [CC-BY-SA 3.0]

The light independent reactions are also known as the dark reactions or **Calvin Cycle** and utilize the ATP and NADPH from the light-dependent reactions to fix gaseous CO<sub>2</sub> into carbohydrate backbones. Photosynthesis is often simplified into  $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light} \rightarrow$

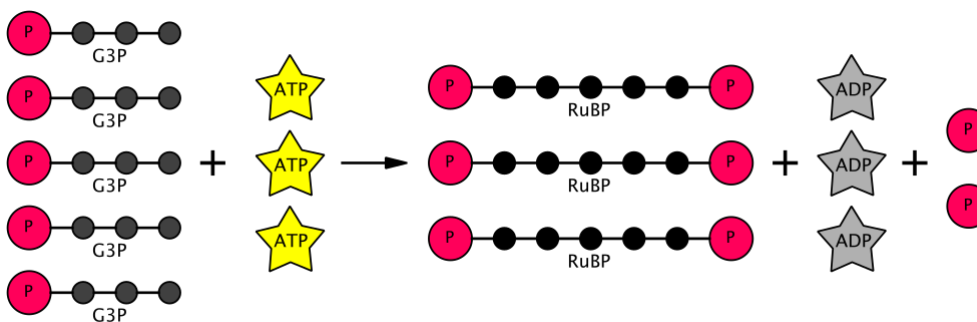
$C_6H_{12}O_6 + 6O_2$ . However, the true product is 3-phosphoglycerate that can be used to generate longer carbohydrates like glucose. The starting point of **carbon fixation** is the carbohydrate Ribulose 1,5-bisphosphate. The enzyme Ribulose Bisphospate Carboxylase (**RuBisCO**) captures a  $CO_2$  molecule onto Ribulose 1,5-bisphosphate to generate 2 molecules of 3-phosphoglycerate which can enter the process of **gluconeogenesis** to generate glucose. ATP from the light reactions can then facilitate the conversion of 3-phosphoglycerate to 1,3 bisphosphoglycerate which can be reduced by NADPH to glyceraldehyde-3-phosphate (G3P). G3P can then be used to regenerate Ribulose 1,5-bisphosphate.



1: Carbon fixation by RuBisCO



2: Reduction by NADPH



3: Ribulose 1,5-bisphosphate regeneration