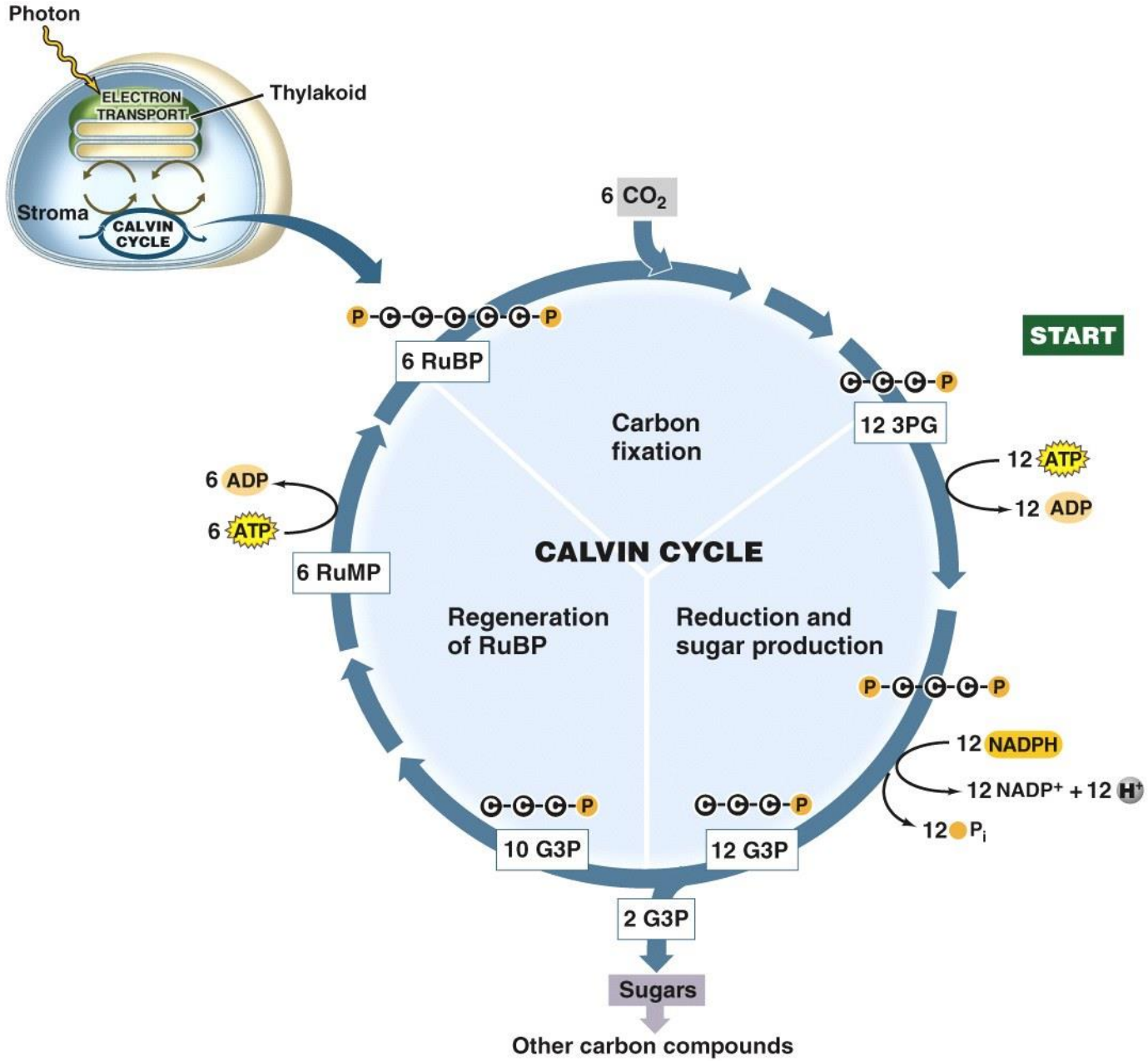
Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

The **Calvin cycle**: CO_2 fixation. It occurs in the stroma of the chloroplast.

Each reaction is catalyzed by a specific enzyme.

Figure 6.21 The Calvin Cycle



***PRINCIPLES OF LIFE*, Figure 6.21**

Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

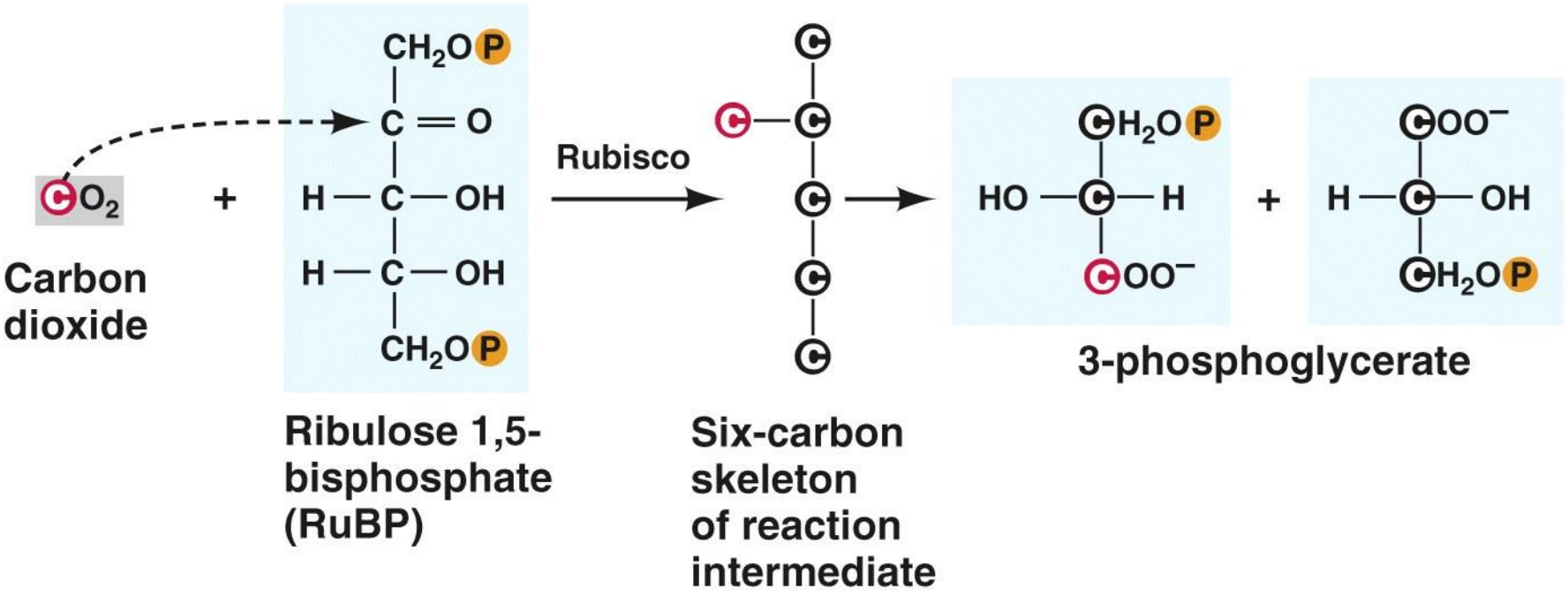
1. *Fixation* of CO_2:

CO_2 is added to ribulose 1,5-bisphosphate (RuBP).

Ribulose bisphosphate carboxylase/oxygenase (rubisco) catalyzes the reaction.

A 6-carbon molecule results, which quickly breaks into two 3-carbon molecules: 3-phosphoglycerate (3PG).

Figure 6.22 RuBP Is the Carbon Dioxide Acceptor



***PRINCIPLES OF LIFE,* Figure 6.22**

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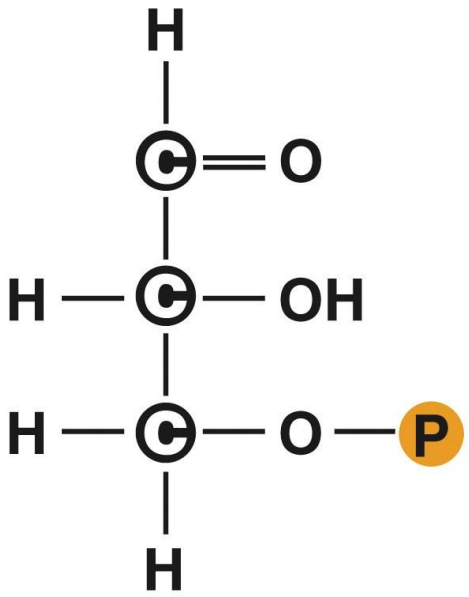
2. 3PG is reduced to form **glyceraldehyde 3-phosphate (G3P)**.



Glyceraldehyde 3-phosphate (G3P)

Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

3. The CO_2 acceptor, RuBP, is regenerated from G3P.

Some of the extra G3P is exported to the cytosol and is converted to *hexoses* (glucose and fructose).

When glucose accumulates, it is linked to form starch, a storage carbohydrate.

Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

The C—H bonds generated by the Calvin cycle provide almost all the energy for life on Earth.

Photosynthetic organisms (**autotrophs**) use most of this energy to support their own growth and reproduction.

Heterotrophs cannot photosynthesize and depend on autotrophs for chemical energy.

Concept 6.5 During Photosynthesis, Light Energy Is Converted to Chemical Energy

Mechanisms of photosynthesis

Work with a partner to be sure you understand the following concepts:

- What are the molecular products of the light reaction, and how are they produced?
- What is the main product of the carbon-fixation reaction, and how is it produced?
- In eukaryotes, such as green plants, where in a cell does the light reaction occur? Where does the carbon-fixation reaction occur?

Discuss your answers with the class.

Concept 6.5 During Photosynthesis, Light Energy Is Converted to Chemical Energy

Chlorophyll molecules of green plants chiefly absorb

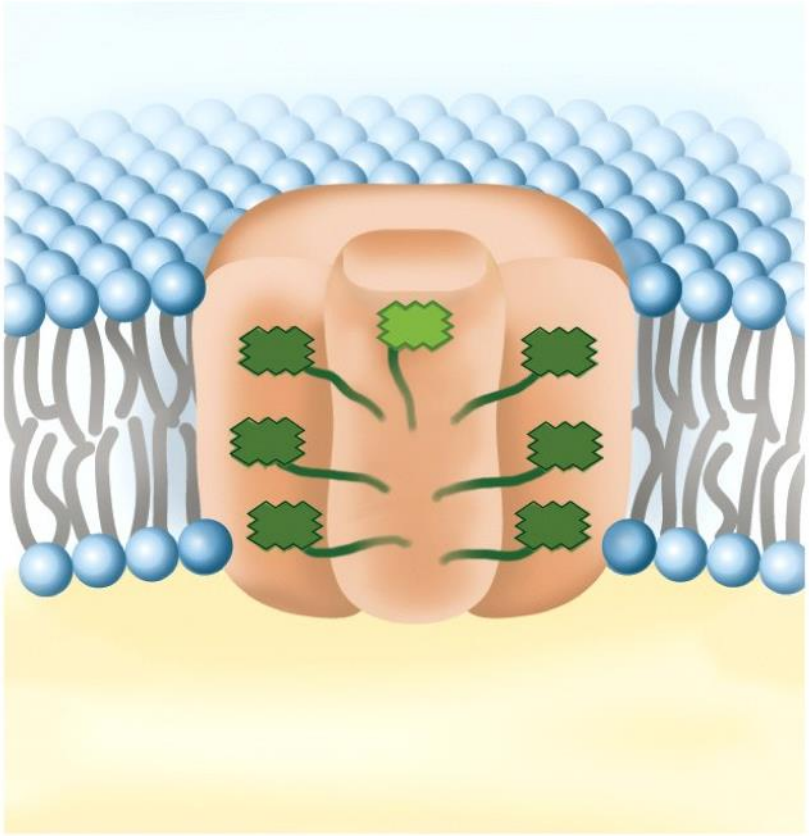
a. red light.

b. yellow light.

c. green light.

d. blue light.

e. Both a and d



Concept 6.5 During Photosynthesis, Light Energy Is Converted to Chemical Energy

Oxygen generated during photosynthesis comes from

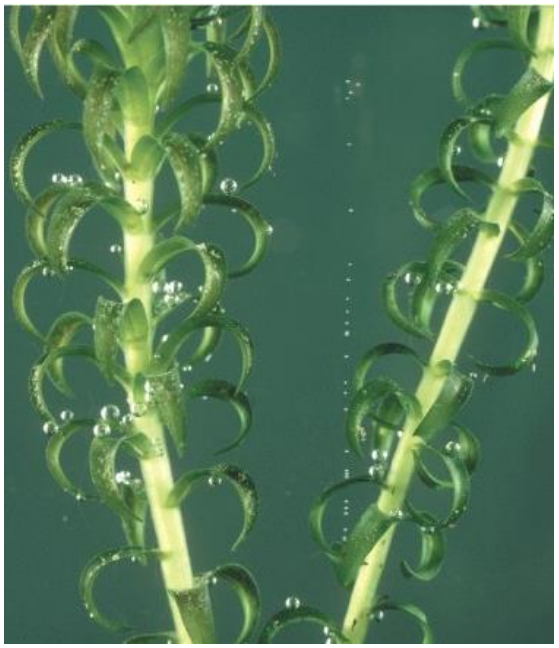
a. atmospheric CO_2.

b. water in the plant's cells.

c. chlorophyll molecules.

d. Both a and b

e. All of the above



Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

The Calvin cycle

Work with a partner to be sure you understand the following concepts:

- Where does the CO_2 that is an input to the Calvin cycle come from?
- Is energy consumed or produced in the Calvin cycle?
- Why must ribulose bisphosphate (RuBP) be regenerated for the Calvin cycle to continue?

Discuss your answers with the class.

Concept 6.6 Photosynthetic Organisms Use Chemical Energy to Convert CO_2 to Carbohydrates

Which statement(s) are correct?

a. An autotroph cannot survive without an external source of food, whereas a heterotroph can.

b. An autotroph can survive without an external source of food, whereas a heterotroph cannot.

c. Microscopic algae in the ocean are examples of autotrophs, and the planktonic organisms that consume them are examples of heterotrophs.

d. Microscopic algae in the ocean are examples of heterotrophs, and the planktonic organisms that consume them are examples of autotrophs.

e. Both b and c