ENVIRONMENTAL SCIENCE JOURNAL FOR TEENS

# How do some algae make the Earth warmer?

**TEACHER'S KEY**

## Check your understanding

**1** How does algae both decrease and increase the amount of greenhouse gases in the atmosphere?

*Answer*

Algae decrease the amount of greenhouse gases in the atmosphere when they photosynthesize. During this process, carbon dioxide is removed from the atmosphere. Algae increase the amount of greenhouse gases in the atmosphere when they produce nitrous oxide from nitric oxide.

**2** What evidence from this study supports the claim that photosynthesis is involved in the reduction of nitric oxide (NO) to nitrous oxide ($N_2O$)?

*Answer*

The results from Experiment 1 show that photosynthesis is involved in the reduction of nitric oxide to nitrous oxide because nitrous oxide is produced at a faster rate in the light than in the dark.

**3** Why do only green algae produce nitrous oxide?

*Answer*

Only green algae have the flavodiiron proteins and/or CYP55 that are needed to make nitrous oxide from nitric oxide.

**4** Enzymes play an important role in the production of nitrous oxide. Can you think of other processes that utilize enzymes?

*Answer*

Answers will vary based on previous knowledge of students. Encourage the students to research enzymes if they are unfamiliar with them.
Some possible answers include:

- Digestion – enzymes help break down larger complex molecules such as fats and starches.
- DNA replication – enzymes help unwind DNA and copy it.
- Detoxification – enzymes in the liver break down toxins in the body.

**5** The article suggests ways for people with gardens to reduce the impact of fertilizer. However, a significant portion of fertilizer runoff comes from agriculture. Research solutions that farms can use to reduce the input of nitrites into bodies of water. Make a list of at least three solutions, and identify which solution you think is the best choice. Explain why you selected this solution.

*Answer*

There are a number of solutions used by farms to minimize fertilizer runoff.

- Nutrient management techniques: apply fertilizer in the right amount, at the right time of year, with the right method.
- Year-round ground cover: farmers plant cover crops or perennial plants so that the ground is never bare. This reduces the amount of runoff and erosion.
- Field buffers: farmers plant trees, shrubs, and grasses along the edges of the fields to absorb or filter out fertilizer before it reaches a body of water.
- Wetland protection: farmers can work with community members and governments to protect wetlands along the edge of a body of water. Wetlands are natural filters for runoff and reduce the amount of fertilizer entering the body of water.
- No-till agriculture: Farmers can avoid tilling or reduce how often and how intensely they till the soil. No-till agriculture reduces the amount of runoff and erosion.

Which enzyme family is responsible for nitrous oxide production in the dark? In the light?

*Answer*

The algae used cytochrome P450 (CYP55) to reduce nitric oxide to nitrous oxide in the dark and flavodiiron proteins (FLVs) to do so in the light.