Cellular respiration, do plants really do it?

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Introduction:

It is a common misconception among urban community college students that only animals do cellular respiration.
Students understand that animals obtain their energy from food, and green plants from the sun through photosynthesis. But they do not quite see where cellular respiration fits on the life of a plant.
We suggest a very simple experiment to promote active learning and clarify this misconception: Grow seeds for about a week with and without light, ask the students to explain why plants grew in the dark. Students will be lead to conclude that the energy for growth came from the seed through cellular respiration

Objective: Demonstrate that plants, like other living organisms, do cellular respiration.

Materials and Methods

Two pots, seeds (preferably of fast growers), cut soda bottle, and aluminum foil for the dark treatment.
Choose a fast grower, in this case *Triticum aestivum,* fill two pots with soil and place seeds on both. Water, cover one with aluminum foil and leave the other exposed to light. Cut soda bottles as mini-greenhouses minimize the need for watering (Fig 1) allowing to leave the system unattended from one week to the next.
After about a week or when the plants in the light are visibly growing, uncover the dark grown etiolated plants (Fig 2).

Fig 1. *Triticum aestivum* plants grown in the dark under aluminum foil, and in the light outdoors for 6 days.

This lab activity is suggested as a **complement to a photosynthesis or respiration lab**, or as preamble to a lecture on photosynthesis.

Fig 2. *Triticum aestivum* plants grown in the dark under aluminum foil (left), and in the light (right) outdoors for 6 days.

Questions for students:

1. Did the plants in the dark do photosynthesis? Why?
2. From where did the plants in the dark get the energy to grow?
3. Did the plants in the light do cellular respiration?
4. Can plants do photosynthesis and cellular respiration simultaneously (Fig 3)?

To promote **active learning** the questions may be given to the students to discuss in groups. As students are answering, draw the axis of the figure bellow (Fig 3) on the blackboard. After asking students what they expect to happen in the dark draw the line.

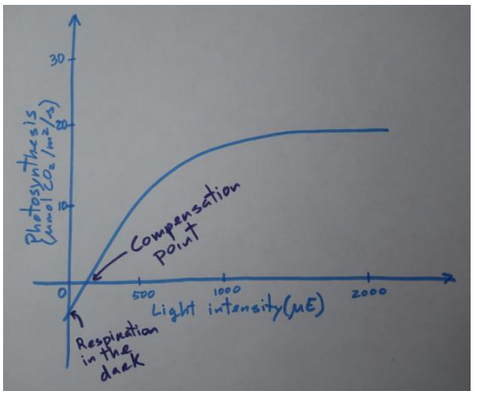

Fig 3. Drawing of a general C3 plant's photosynthetic response to light. Note that below zero photosynthesis what is observed is cellular respiration. The compensation point is where the plant releases as much CO_2 in respiration as it consumes in photosynthesis.

Critical thinking question:
Does the plant compete with you for oxygen if it is in your bedroom at night?

After thinking about these topics students should be able to think about forests and phytoplankton in oceans as sinks of CO_2, and predict what forest will be a larger sink, a young plantation or an established old forest, by relating relative rates of photosynthesis and cellular respiration.

Students could also be shown the photo of a parasitic white plant and discuss where it obtains energy from.