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EFFECTS OF TEMPERATURE ON THE PHOTOSYNTHESIS OF THE ANTARCTIC GREEN ALGA, *CHLORELLA VULGARIS* (ABSTRACT)

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In order to elucidate how Antarctic terrestrial microalgae can grow at a low average year-round temperature below 0°C, we used a unicellular Antarctic green alga, *Chlorella vulgaris* strain SO-26, as material for this study. The alga was isolated from a wet moss surface, near Syowa Station, Antarctica. The temperature on the moss surface ranged from 20°C on a sunny day in summer to about −30°C in winter. A mesophilic alga, *C. sorokiniana* strain C-133, provided by IAM (Institute of Applied Microbiology, the University of Tokyo, Japan), was used as a control. These algae were pre-cultured axenically in our laboratory at 20°C under fluorescent light at about 22 μmol m^{-2} s^{-1}. These algal materials were cultured with a shaker at different temperatures at 64–85 μmol $m^{-2}s^{-1}$ illumination, and the cell numbers were counted after two weeks. Strain SO-26 could grow between 5 and 30°C, while strain C-133 could grow between 10 and 40°C, a higher temperature range than that of strain SO-26.

The photosynthetic O_2 evolution of the algae pre-cultured at 20°C was, then, measured at different temperatures with an oxygen electrode. Strain SO-26 could photosynthesize between 0 and 35°C, with an optimum at 20°C. On the other hand, strain C-133 could photosynthesize between 5 and 45°C, with an optimum at 35°C. When strain SO-26 was heated to 40°C for 30 min, it lost its photosynthetic activity at 20°C, while strain C-133 retained its photosynthetic activity after the 45°C treatment for 30 min. After refrigeration of both strains at −20°C for 3 hour, only strain SO-26 retained its photosynthetic activity. These results show that the Antarctic alga, *Chlorella vulgaris* SO–26, has psychro- and freeze-tolerant properties besides its thermolabile property, and that the alga is well adaptable to Antarctic environments.

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