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PHOTOSYNTHATE PARTITIONING IN PSYCHROPHILIC MARINE DIATOM ISOLATED FROM THE ANTARCTIC OCEAN (EXTENDED ABSTRACT)

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Our present knowledge of the physiology and biochemistry of marine psychrophilic algae is limited. As a first step toward understanding the mechanisms of adaptation to low temperature, the photosynthetic activity and distribution of assimilated carbon in major photosynthetic end products were investigated at various incubation temperatures. Alga used for this experiment was a marine psychrophilic diatom, *Navicula* sp. strain D, isolated from the open water of Indian Sector of the Antarctic Ocean by one of the authors (H.T.). For comparison of its characteristics, a mesophilic marine diatom, *Phaeodactylum tricornutum*, was also used.

Strain D and *P. tricornutum* were grown at 7 and 20°C, respectively. The photosynthetic activity and the partitioning of assimilated carbon compounds were measured by the incorporation of $NaH^{14}CO_3$ into whole cells, perchloric acid (PCA)-soluble, chloroform-methanol-soluble, trichloroacetic acid (TCA)-soluble and particulate fractions. The latter four fractions were operationally defined as low molecular weight (LMW) compounds, lipid, polysaccharide and protein, respectively.

The photosynthetic activity of strain D was maximum at 17°C and decreased markedly above 20°C. The activity at 3°C was about 40% of the maximum (Fig. 1a). On the other hand, maximum activity of *P. tricornutum* was observed at 25°C and only 15% of maximum activity was exhibited at 5°C (Fig. 1b).

The distributional pattern of ^{14}C incorporated in strain D was also different from that in *P. tricornutum*. In strain D, the proportion of ^{14}C in LMW fraction was higher at higher temperature, especially above the photosynthetic optimum temperature. This increase was accompanied by the decrease in the protein, lipid and polysaccharide fractions (Fig. 2a). On the contrary, the increase in the proportion of ^{14}C incorporated into LMW fraction in *P. tricornutum* was observed at lower temperature (Fig. 2b).

These results for strain D suggest that one or some steps for the synthesis of biopolymers such as lipid, polysaccharide and protein may be inhibited or inactivated at higher temperature, although $NaH^{14}CO_3$ can be incorporated into LMW compounds above 17°C. As for mesophilic *P. tricornutum*, the rate of transformation into the biopolymers was lower at lower temperature whereas that of strain D was maintained.

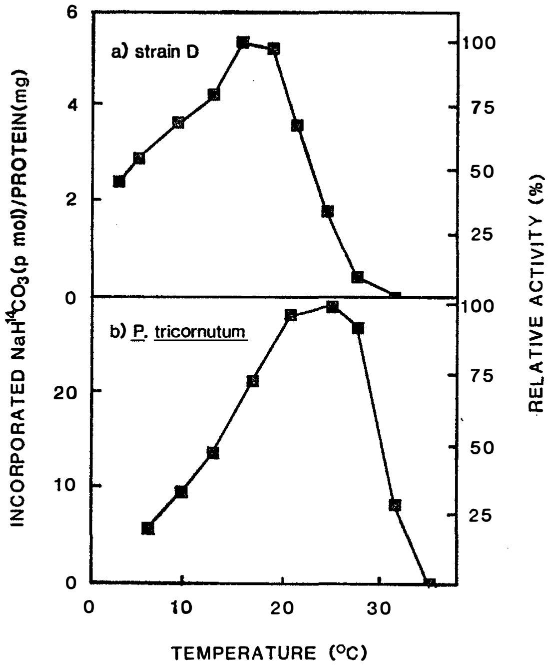

Fig. 1. *Total incorporation of $NaH^{14}CO_3$ into the cells of a)* Navicula *sp. strain D, b)* Phaeodactylum tricornutum *at logarithmic phase incubated at different temperatures between 3°C and 36°C under the photosynthetically saturated light for 4 h.*

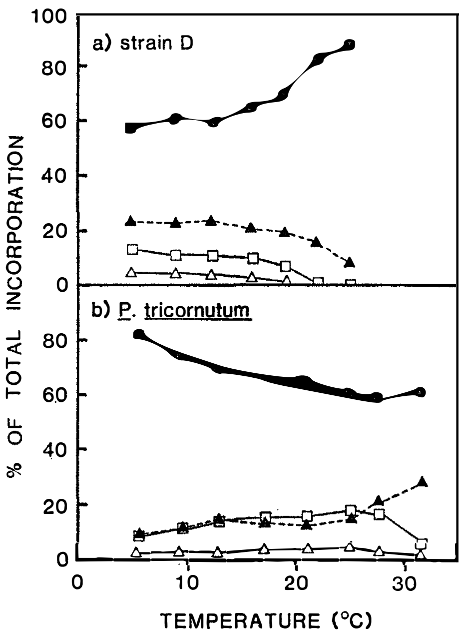

Fig. 2. *The distribution of $NaH^{14}CO_3$ incorporated in four cellular organic fractions of a)* Navicula *sp. strain D, b)* Phaeodactylum tricornutum *incubated at different temperatures. —■—, perchloric acid-soluble fraction (LMW compounds); —▲—, chloroform-methanol-soluble fraction (lipid); —△—, trichloroacetic acid-soluble fraction (polysaccharide); —□—, particulate fraction (protein).*

Further metabolic studies of strain D and comparisons of its characteristics with those of mesophilic algae would help understand the mechanisms of adaptation of psychrophilic algae to cold temperature.

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