

PHYSIOLOGY OF LOW TEMPERATURE ACCLIMATION IN TROPICAL POIKILOTHERMS

IV. Quantitative Changes in the Nucleic Acid Content of the Tissues of the Freshwater Mussel, *Lamellidens marginalis*

BY KANDULA PAMPAPATHI RAO

(Department of Zoology, Sri Venkateswara University, Tirupati, India)

Received February 25, 1963

(Communicated by Dr. H. Srinivasa Rao, F.A.Sc.)

INTRODUCTION

IN the previous papers it was shown that during cold acclimation the free amino acid content of the blood decreases while the protein content of the cells increases. This was interpreted to mean that there is increased protein synthetic activity in active cells and tissues, resulting in a nett movement of amino acids into proteins in the cells. It is well known that such increased protein synthetic activity is measurable in terms of increases in the nucleic acid (RNA) content of such tissues. If there were to be increased protein synthesis during cold acclimation, tissues of cold acclimated individuals should show an increase in nucleic acid concentration. Hence, as a necessary corollary to the previous investigations, the nucleic acid content of certain tissues of cold acclimated mussels was measured and compared to the nucleic acid level of normal animals.

MATERIAL AND METHODS

The freshwater mussels, *Lamellidens marginalis*, were collected near Tirupati and treated as reported earlier. After acclimation to 29° and 19° C. for four weeks the hepatopancreas, foot and ctenidium of the normal and cold acclimated mussels were analysed quantitatively for nucleic acid phosphorus contained in those tissues. Determinations were made on a large number of mussels of a wide size range. The method used was the spectrophotometric method described in detail by Spirin (1958). A Hilger UVISPEC Spectrophotometer was used in the present investigation to measure the absorption spectra.

RESULTS AND DISCUSSION

Figure 1 shows the nucleic acid phosphorus in the three different tissues in the normal and cold acclimated mussels as a function of

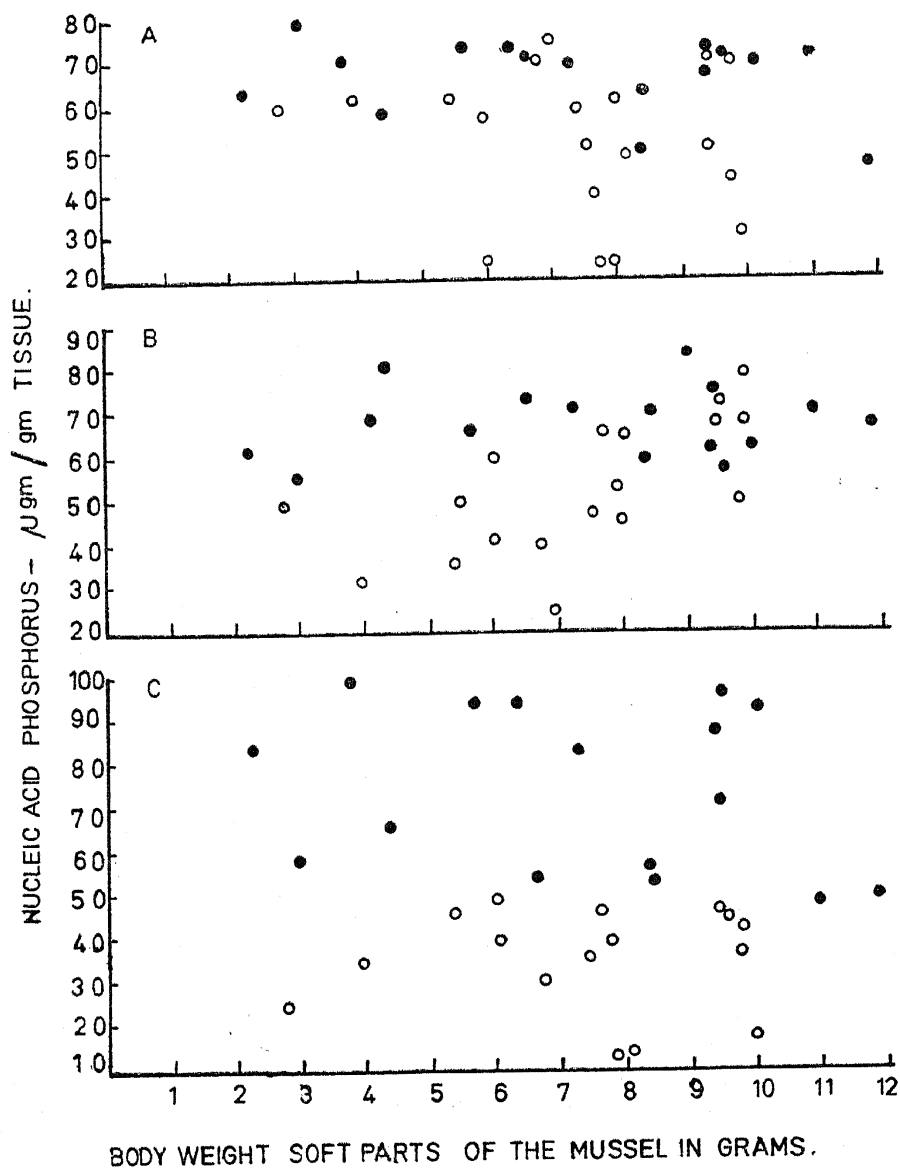


FIG. 1. Nucleic acid phosphorus in different tissues of cold acclimated (19° C.) mussels compared with that in normal (29° C.) mussels. Closed circles for cold acclimated individuals and open circles for normal individuals.

A. Ctenidium; B. Foot; C. Hepatopancreas.

the weight of the animal. No relation between the weight of the individual and the nucleic acid content of its tissues is noticed. But it is clearly seen from the figure that the cold acclimated mussels exhibit in general higher

levels of nucleic acid phosphorus (closed circles in figure) and this is particularly conspicuous (82% over normal) in the hepatopancreas. In the foot and the ctenidium also there is an increase of 15.6% and 22.2% respectively (on the average) in the nucleic acid content in the cold acclimated individuals as compared to the normal. While the increase in nucleic acid phosphorus in the foot and ctenidium of cold acclimated individuals may not be significant, the increase in the hepatopancreas is highly significant. A similar increase (about 15%) in the RNA content of cold acclimated earthworms was observed by Saroja (1962).

These results indicate a general increase in the nucleic acid content in the tissues of the cold acclimated mussels. In the light of the results reported earlier, this increase in the nucleic acid content can be interpreted to indicate an increased protein synthetic activity in cold acclimated individuals. This conclusion is further strengthened by the fact that the increase is greatest in the metabolically most active tissues (*viz.*, the hepatopancreas) as compared to the ctenidia and the foot. Such an increase of the nucleic acid phosphorus associated with increase in protein synthesis has been amply demonstrated in insects (Wigglesworth, 1961).

SUMMARY

There is an increase in the nucleic acid phosphorus in the tissues of cold acclimated individuals as compared to normal mussels. This increase is greatest in the hepatopancreas (82% over normal) and less in the ctenidium (22.2%) and the foot (15.6%). It is suggested that this increase in the nucleic acid during acclimation to low temperature is associated with increased protein synthesis.

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