CHAPTER VIII

QUANTITATIVE VARIATIONS IN RNA AND DNA IN THE WHITE MUSCLE OF WALLAGONIA ATTU (SCHN.) DURING GROWING PHASE.

INTRODUCTION

This chapter reports quantitative changes in RNA and DNA in the white muscle of the so-called freshwater shark Wallagonia attu (Schn.) during its growth in the pre-maturity phase.

MATERIALS AND METHODS

(See under 'PROCEDURE AND METHODOLOGY')

RESULTS AND DISCUSSION

As can be seen from Table VIII and Fig. 13 that concentrations of RNA and DNA in the white muscle of the specimens of Wallagonia attu of I size-group were 104.161 ug/100 mg and 20.933 ug/100 mg, respectively, whereas in II size-group individuals the concentration of RNA was 134.763 ug/100 mg and that of DNA was 17.419 ug/100 mg. Evidently, growth in body length of Wallagonia attu was accompanied by an increase in the level of RNA and decrease in the amount of DNA/unit weight of muscle tissue. This increase in RNA during growth seemed to be
related to increase in the consumption of food by fish. More voluminous food intake by fish during growth in early life has been regarded by Love (1970) as to meet the increasing metabolic requirements of the growing body. Rise in RNA level with metabolic activity is in keeping with the views expressed earlier (Mustafa, 1977a; see also chapter II) concerning the correlation between RNA concentration and functional status of tissues.

Further, since pre-maturity phase of fish is characterized by the most active growth, increase in RNA which acts as template in protein biosynthesis, is a pre-requisite to sustain the growth process. The other factor which can also account for increase in RNA concentration during growth of *Wallagongia attu* appears to be the change-over from a less proteinaceous diet to a more proteinaceous one. Change in the food spectrum of this species has been reported in an earlier communication (Ansari & Mustafa, 1978). That the concentration of RNA in tissues is related to the amount of food consumed, especially the proportion of protein, has been reviewed by Brachet (1955) and Leslie (1955). Enhancement of RNA biosynthesis as a consequence of the substitution of low protein diet by protein rich food in case of *Channa punctatus* was documented by Mustafa & Jafri (1977).

The apparent decline in DNA concentration by lengthening of body is probably a manifestation of decrease in the number of cells which contribute to unit weight of muscle sample. This is
so because during enlargement of body length there occurs increase in the size of cells rather than their number and consequently the quantity of DNA in unit weight of muscle tissue is expected to reduce to half, when the fish doubles its body length, since this results in halving the number of cells in unit weight of tissue (Love, 1970). However, present data leaves no doubt that DNA amount is not reduced to half, because its ratio in muscle of the specimens of larger (II) size-group to the smaller (I) size-group is greater than 0.5 (precisely 0.832). The conclusion which can be derived from this finding is that during growth of muscle cells DNA is synthesized and this obviously compensates to some extent the decline in its concentration due to reduction in the number of cells per unit weight of tissues. The hypothesis presented by Love (1958) that a given amount of DNA can control only a definite amount of cytoplasm, and additional quantity must be synthesized when cytoplasmic volume increases beyond a certain limit in growing cells, extends support to the finding on Wallagonia attu. Concordant views have been expressed by Mustafa (1977 a) for some freshwater carps. A comparison of the present data with the values of RNA and DNA in these teleosts reveals interspecific differences. In addition to differences in the preformed amounts of the nucleic acids, having a genetic basis, the interspecific variations may be attributed to a number of other factors.
Inasmuch as RNA concentration fluctuates widely with the nutritional status, stage of growth and other conditions of life, showing even marked interspecific variations, the differences in the DNA which is a relatively more stable component could owe their origin to differences in the number of cells forming given weight of muscle samples. Since all the species of fishes analysed belonged to different body lengths, lengths and weights of muscle fibres must differ, and one can but expect differences in the number of cells/unit weight of tissue, which is known to be quite influential in determining the DNA concentration at tissue level. Another factor to be considered is polyploidy whose effect on DNA concentration has been documented by Leslie (1955), Giese (1973), Mustafa (1978b). But interpretation of interspecific differences on this basis will be unreasonable because of the fact that polyploidy is linked with the level of metabolic activity of cells (Vendrely, 1955) and white muscle of all the fishes is identical in performance of function which is of the same mechanical nature.

Ratio of DNA in *Wallagonia attu* of the two size-groups (II/I) was calculated to be 0.832, which is higher than such ratios reported by Mustafa (1977a) for *Catla catla* (0.744) and *Labeo rohita* (0.752). Obviously, interspecific differences exist in the amount of DNA that arises epigenetically during growth in
cell size when fishes double their body length. On a comparative basis, a higher ratio in *Wallagonia attu* implies that larger additional quantity of DNA is required for physiological integrations in the cat-fish, resembling in this respect with *Labeo bata* where the ratio was found to be 0.842 (Mustafa, 1977a).

**SUMMARY**

Changes in the concentrations of RNA and DNA in the white muscle of *Wallagonia attu* during its growth were investigated. Increase in RNA and decrease in DNA were observed when fish doubled its body length. These quantitative variations in nucleic acids have been interpreted in detail. The data was compared with the values of RNA and DNA reported for other teleostean species and interspecific differences were discussed.