CHAPTER III
RNA AND DNA CONCENTRATIONS OF MAJOR CARP CIRRHINA MRIGALA FRY FED COMPOUNDED DIETS

INTRODUCTION

This study was designed to determine the influence of artificially compounded diets on nucleic acid turnover in tissues of major carp Cirrhina mrigala fry. Work embodied and reviewed under Chapter II emphasized the importance of RNA and DNA as useful biochemical tools for evaluating the health and nutritional status of fish. There is, however, a general paucity of literature on larval fish nucleic acids. Data presented in this Chapter familiarizes with new concepts and strikes caution against synonymizing increase in RNA/DNA ratio with growth rate of fish.

MATERIALS AND METHODS

Cirrhina mrigala fry averaging 1.35 in length and 0.02 g in body weight were reared in continually aerated laboratory aquaria. Temperature, pH and dissolved oxygen content of the water were 27°C, 7.5, 4.5-4.7 ppm, respectively. Two types of diets 'A' and 'B' (vide 'A' and 'C': Chapter II) were supplied separately to the two batches, each of 100 specimens. Unused
food was siphoned off daily. After 30 days of feeding, the fish were taken out, recorded for their weight, decapitated and muscle samples were processed for determination of RNA and DNA concentrations according to the methodology outlined in Chapter I.

RESULTS AND DISCUSSION

Data on nucleic acid concentrations in the muscle of *Cirrhina mrigala* fry (Fig. 1 Table I) revealed complexity in the turnover behaviour of these macromolecules. The pattern of change in RNA and DNA in early life history differed basically from that reported for adult growing fishes in earlier communications (Mustafa and Jafri 1976; Mustafa 1977a, 1978). Indeed, the analysis of growth stanzas in fishes at different phases of their life shows profound variations in the growth character during the normal life span. Discordancy in the underlined biochemical processes is believable. Specimens of *Cirrhina mrigala* maintained on the diet 'B' which gave the best of results in terms of growth, conversion efficiency and protein utilization had the lowest concentrations of RNA and DNA compared to those supplied diet 'A'. One possible reason may be that in the post-larval stage the high rate of growth does not necessarily require an equally fast epigenetic synthesis of RNA. The preformed RNA can be credited with turning out greater quantities of protein essential to sustain growth. This implies that the available RNA is hard pressed but effective
in dealing with the protein demands of growing fish. The requirement of additional quantities of RNA by way of gene-derepression can thus be preempted/precluded by enhanced efficiency of the various types of RNAs. While Mustafa (1977a) reported gene-repression in cells of catfish Clarias batrachus undergoing gonad building, Mustafa and Shams (1979) observed gene-derepression in recovering samples of this species (larval stage not investigated). A comparison of these findings with the present results throws light on the possible change in the efficiency of RNA to synthesize protein during various stages of life. Observations embodied here signify that efficiency/potency is higher in early life (larval/post-larval stages). The information must be helpful in georontological studies.

Data published by Mustafa and Jafri (1977) and Mustafa and Zofair (1983) elaborated that the quantity of protein arising epigenetically depends upon nutritional value of the diet, especially the proportion of protein. In the processing techniques adopted for the present study the dehydration, defattening and removal of acid-soluble substances were so thorough that protein was the constituent that mainly remained in the muscle samples. Since actual reduction in DNA content of cells of fish provided nutritionally superior diet is unbelievable, there is every reason to attribute the decline in DNA concentration (amount/unit weight of tissue) to increased percentage of protein and hence
'dilution' of the nucleic acids. The reduction in DNA concentration outweighs even the increase in cellular DNA to control larger volume of cytoplasm in growing and more robust cells. Mustafa (1977a, 1978) has convincingly explained such a nuclear DNA-cytoplasmic volume relationship and the epigenetic origin in several species of teleosts. It is here that the differentiation of 'cause-and-effect' relations in molecular biology assumes importance. The interpretation centers on nuclear DNA. The extranuclear DNA and its role in protein biosynthesis cannot, however, be ruled out. Klein et al. (1962) concluded that the extranuclear DNA is involved in activation of the synthesis of required type of protein from the inactive native proteins of the cells. Mustafa and Mittal (1984) have endorsed this view. Further research is needed to understand if this cytoplasmic DNA is the one which is extruded out of the nucleus after it crosses the accommodating capacity and to know its modus operandi.

SUMMARY

Concentrations of RNA and DNA in Cirrhina mrigala fry supplied two kinds of compounded diets, 'A' (linseed oil cake, wheat bran, sugarcane roughage, blood meal, egg shell in the ratio 30:25:12:30:3) and 'B' (linseed oil cake, sugarcane roughage, blood meal in the proportion, 50:40:10) were evaluated.
Response of nucleic acid content/unit weight of tissue in the larval fish was basically different from that of the adult. RNA and DNA concentrations were lower in fry fed died 'B' compared to those of the other batch. Results implied a higher efficiency of RNA in protein biosynthesis at larval stage, but did not indicate actual reduction of cellular DNA content by dietary manipulations.
Fig. 1. Concentrations of RNA (white bars) and DNA (black bars) in the muscle of Cirrhina mitgala fry fed different diets. Vertical lines indicate standard error of mean.
The figure shows the comparison of RNA and DNA content (μg/100 mg) in two diets labeled A and B. The RNA content in diet A is significantly higher than in diet B. The DNA content is lower in both diets, with no significant difference between the two diets.
TABLE I. Nucleic acid concentrations in the muscle of *Cirrhina mrigala* fed artificial feeds (A, B)

<table>
<thead>
<tr>
<th>Diets</th>
<th>RNA, μg/100 mg</th>
<th>DNA, μg/100 mg</th>
<th>RNA/DNA</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1003.04 ± 13.73</td>
<td>337.25 ± 16.84</td>
<td>2.974</td>
</tr>
<tr>
<td>B</td>
<td>828.96 ± 11.76</td>
<td>313.5 ± 20.21</td>
<td>2.644</td>
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