CHAPTER II

DISTRIBUTION OF NUCLEIC ACIDS IN DIFFERENT TISSUES OF

CLARIAS BATRACHUS (Linn.)

INTRODUCTION

An attempt has been made to present data on the concentra­
tions of RNA and DNA in different tissues, including those of
heart, kidney, liver and the skeletal muscle of Clarias batrachus
(Linn.). Interpretation of the differences in the relative
amounts of the two nucleic acids in each of the tissues is also
an important outcome of this study.

MATERIALS AND METHODS

(See under "PROCEDURE AND METHODOLOGY").

RESULTS AND DISCUSSION

Concentrations of RNA and DNA in the skeletal muscle,
heart, kidney and liver of Clarias batrachus have been given in
Table II and shown in Fig. 7. The application of Chi-Square ($X^2$)
test revealed marked ($P < 0.001$) heterogeneity in the distribu­
tion of nucleic acids in different tissues. Highest concentra­
tion of RNA was recorded in the liver, followed by the kidney,
heart, and lowest values were encountered in the flesh (skeletal
muscle). Since the concentration of RNA in tissues is known to
be an index of metabolic activity (Brachet, 1955; Leslie, 1955),
the significantly higher values of RNA in liver, an important seat of metabolic functions, and relatively lower concentration of this nucleic acid in tissues like skeletal muscle and those of kidney and heart, which are more active mechanically are quite obvious.

The pattern of DNA distribution seemed to differ from that of RNA in that of all the tissues investigated its highest value occurred in kidney. Liver was the organ with DNA concentration next to kidney; the values then declined in the order: heart—skeletal muscle. Although variations in the actual amount of DNA in the individual cells of the different somatic tissues could not be ruled out, the differences in the DNA concentration were attributed to other factors also, such as the number of cells/unit weight of tissue, and polyploidy. Tissues with larger number of cells in a given weight and with higher ploidy are known to yield greater concentration of DNA (Leslie, 1955; Mustafa, 1978b). Mustafa (1976) expressed the view that because of narrower dimensions of hepatic cells in comparison with muscle fibres, larger number of cells contributing to the unit weight of liver can account for higher DNA concentration in this organ, but since data on the exact cellular dimensions is not available this point can be outlined only as a possibility and not a basis of specific interpretation vis-à-vis heterogeneity in DNA distribution in fish tissues. Vendrely (1955) documented that frequency of polyploid cells and degree of polyploidy of
Individual cells in a tissue are related to metabolic activity. The same author reported for liver as containing a larger population of three kinds of nuclei - diploid, tetraploid and octaploid and for kidney as having only diploid nuclei. Despite this, however, the lower concentration of DNA in liver than the kidney only indicates that factors other than polyploidy can potentially exert an overriding influence in determining the DNA concentration. Creelman & Tomlinson (1959), also published results of the nucleic acid analyses on sockeye salmon which are consistent with the present data but avoided any comment on possible basis of the differences in the DNA concentration between liver and kidney.

In all the nucleic acid investigations at the tissue level, one cannot lose sight of the effect of differences in the relative amounts of both extracellular and intracellular materials (other than nucleic acids), since they contribute to the samples used for analyses. Any increase in these substances, especially the water, on freshwater basis, will, invariably amount to a so-called 'dilution effect' on the nucleic acid concentrations (amount/unit weight) rather than their contents in individual cells.

The highest RNA/DNA ratio was found in the case of skeletal muscle (3.556). Although this tissue was poorest in RNA as well as DNA, but the amount of DNA relative to RNA was much lower.
and hence the high RNA/DNA ratio. The ratio for the liver was 2.142, implying that RNA was a little more than twice as much concentrated as the DNA. The proportion of RNA to DNA in the heart was even less than that in the liver; the ratio being only 1.329. The lowest ratio was encountered in the kidney (0.744) where the DNA concentration even exceeded that of the RNA.

**SUMMARY**

RNA and DNA in the skeletal muscle, heart, kidney and liver of *Clarias batrachus* were assayed quantitatively. Marked heterogeneity which characterized the distribution of nucleic acids has been interpreted in detail. The RNA/DNA ratios for the various tissues investigated were evaluated to bring to light the differences in relative proportions of the two nucleic acids in the tissues.
Fig. 8. Concentration of RNA (dotted bars) and DNA (striped bars) in the flesh of male and female specimens of *Clarias batrachus*. 