

SUMMARY

Chapter 1

The histological structure of the adipose tissue of the frog, lizard, pigeon and bat were studied. In bat there are present two types of adipose tissue, namely, brown and yellow, while in all the other animals studied only the latter type is known to be present. The histological structure of the brown and yellow adipose tissue is different. The nuclei of the latter lie at the periphery of the cell and the cytoplasm is also confined to the cell periphery, the inside of the cell being filled with a single fat droplet. The nuclei of the brown adipose tissue are eccentric and the relative amount of cytoplasm is much more than in its counterpart. The lipid droplets present in the individual cells do not become confluent and hence the cytoplasm has a vacuolated appearance. The yellow adipose tissue in all the animals studied is more or less identical in its histology. The vascular density of the pigeon adipose tissue is considerably high.

Chapter 2

The adipose tissue of the pigeon was analysed by histochemical methods. Lipase was found to be present in considerably high concentrations. Enzymes, alkaline phosphatase, acid phosphatase, ATPase, dehydrogenases like, succinic, lactic, malic, glycerophosphate, glutamic were found to be present in appreciable quantities. The large quantities of fat occurring in this tissue are mainly in the form of neutral fats. Phospholipids and cholesterol, though present, are only in minor quantities. Sulphydryl groups and water-insoluble aldehydes and ketones were also found to be present. Glycogen was not detected. The

significance of these observations are discussed.

A histochemical study of certain enzymes in the adipose tissue of the fowl and rosy pastor revealed that this tissue in the latter contains higher quantities of lipase and alkaline phosphatase while the amount of succinic dehydrogenase in the two was found to be more or less the same. The rosy pastor is a migrant and enormous quantities of fat are deposited in its adipose tissue during the premigratory period. For the synthesis of this fat, large quantities of lipase, as is present is deemed essential. Alkaline phosphatase also appears to be connected with lipid metabolism in this tissue. The lipid metabolism of the rosy pastor adipose tissue, it is suggested, is higher than that of the fowl and the oxidative metabolism appears to be more or less the same.

Chapter 3

A study of the histochemical reaction for lipase, alkaline phosphatase, acid phosphatase, ATPase, succinic dehydrogenase, lactic dehydrogenase, phospholipids, cholesterol, sulphydryl groups and water-insoluble aldehydes and ketones in the brown and yellow adipose tissue of the bat revealed that the two types of adipose tissue differ in physiological activity. The brown adipose tissue showed a higher concentration of succinic dehydrogenase, lactic dehydrogenase, phospholipids, cholesterol and sulphydryl groups. No detectable difference between brown and yellow adipose tissue was, however, found with respect to lipase, alkaline phosphatase, acid phosphatase, ATPase and water-insoluble aldehydes and ketones.

Chapter 4

The lipase in the locust fat body was studied by manometric and histochemical methods, and this enzyme was found to occur in large quantities. The enzyme concentration was $312.3 \mu\text{l CO}_2 / \text{mg protein} / \frac{1}{2} \text{ hour}$. This is more than double the amount of the same enzyme present in the pigeon adipose tissue and many times more than what occurs in the flight muscles of the locust. The large concentration of lipase present appears to be useful for the synthesis and breakdown of the fat store in this tissue. The fat body, it is suggested could be a source of fat supply as energy fuel to the muscle, especially for sustained activity as during migratory flights. Alkaline phosphatase is also present in appreciable quantities.

Chapter 5

The lipase activity in the visceral adipose tissue of the frog, lizard, pigeon, fowl and rosy pastor and the subcutaneous brown and yellow adipose tissue of the bat, were determined by manometric method, using the Warburg apparatus. The concentration of the enzyme is comparatively high in the lizard, pigeon and rosy pastor, while in the other vertebrates studied it is low. The amount of lipase present in the adipose tissue is suggested to be an index of the capacity of the tissue to synthesize fat (glycerides) and also bring about its subsequent breakdown. It is also suggested that lipase activity is less in the adipose tissue of those animals in which the fat is gradually built up and gradually used up, but on the other hand it is very high in those in which fat is built up rapidly for a large scale utilization

in a short period.

Chapter 6

Certain biochemical properties of lipase in aqueous extract of ether-defatted dry adipose tissue of the pigeon was studied in a manometric system, using tributyrin as substrate. No cation requirement for the enzyme activity could be demonstrated. This enzyme is inhibited by sodium taurocholate, Krebs cycle intermediates and lactate. PCMB and HgCl_2 were both inhibitory. 8-hydroxyquinoline activated the enzyme, so also ATP. Glutathione activated the enzyme while cysteine was found to be inhibitory. The inhibition by PCMB was reversed completely by the addition of glutathione. BAL was also inhibitory. The enzyme appears to be an -SH enzyme or one requiring -SH or -S-S- for activity. It is found that the enzyme activity is not dependent upon the presence of metal or metals.

Chapter 7

The in vitro oxygen consumption by the adipose tissue without added substrates and co-factors was studied in Ringer phosphate and Krebs-Ringer bicarbonate media, by the Warburg manometric method. The values obtained for the pigeon adipose tissue were on the average, $12.45 \mu\text{l O}_2 / 100 \text{ mg tissue / hour}$ and $8.77 \mu\text{l O}_2 / 100 \text{ mg tissue / hour}$ respectively in Ringer phosphate and Krebs-Ringer bicarbonate. Ringer phosphate was found to be a better medium than Krebs-Ringer bicarbonate for the pigeon adipose tissue. The value of oxygen consumption by the brown and yellow adipose tissue of the bat, in Ringer phosphate medium, was $78.30 \mu\text{l O}_2 / 100 \text{ mg tissue / hour}$ and $11.69 \mu\text{l O}_2 / 100 \text{ mg tissue / hour}$.

hour respectively. The oxidation of various metabolites in the absence of added co-factors, was also studied. Succinate was found to be oxidized the most and pyruvate the least with mean values of 25.04 $\mu\text{l O}_2$ / 200 mg tissue/ hour and 1.75 $\mu\text{l O}_2$ / 200 mg tissue/ hour respectively. The average total protein content of the fresh, pigeon adipose tissue was 2.478 mg/ 100 mg tissue, and 6.70 mg/ 100 mg tissue and 0.808 mg/ 100 mg tissue, respectively, for the brown and yellow adipose tissue of the bat.

Chapter 8

The results obtained have been discussed with a view to present in a comprehensive manner the available information on the histophysiology of the adipose tissue.