SUMMARY AND CONCLUSIONS

Chapter 1

The relative distribution pattern of the narrow red and the broad white fibres, and the SDH activity in the different layers of the pigeon breast muscle were studied quantitatively. It was found that the activity of this enzyme in any particular layer of the muscle is more or less related to the mumber of the narrow red fibres present there since the main bulk of the enzyme resides in these fibres.

Chapter 2

Some histochemical and cytochemical observations on the exact localization and distribution of SDH system and cytochrome oxidase in the pigeon breast muscle were made by employing slightly modified methods. SDH activity which was not detected earlier either histochemically or biochemically in the broad white fibres, was demonstrated by using a modified incubation medium under strict anaerobic conditions with NT as the hydrogen acceptor. The size, localization and distribution pattern of the histochemically demonstrable doformazan and indophenol blue granules, showed more or less a close resemblance with the mitochondrial staining in the individual red as well as white fibres. The occurrence of high oxidative metabolism in the narrow red fibres was revealed by the presence of a large number of SDH-positive granules in these fibres. On the other hand the presence of a few such smaller granules in the broad white fibres indicated very low oxidative metabolism.

The presence of the few smaller SDH-positive granules in the broad white fibres is nevertheless, indicative of the fact that these fibres too possess mitochondria where some measure of oxidative activity howsoever little, does take place and that they are to be considered as analogous to the white fibres of the other vertebrate skeletal muscles. It is also suggested that these granules are to be considered as mitochondria in the general sense and that the distinction into sarcosomes and mitochondria as proposed by previous authors needs reconsideration.

Chapter 3

Iron and protein contents were determined in the different layers of the pigeon breast muscle on the basis of the distribution pattern of the broad and narrow fibres in the pectoralis major muscle of the pigeon. The variation in the iron and protein contents in the different layers was found to be due to the variation in the ratio of the distribution pattern of the two types of fibres. Iron content was found to be highest in the interior of the muscle and lowest in the superficial layers. The protein content showed a reverse pattern but the increase in the superficial layers was, however, not very sharp. From the statistical analysis of the results obtained it was possible to derive the iron and protein contents of the two fibre types, without isolating them. The possible significance associated with the differences in the iron and protein contents of the two types of fibres in this muscle is discussed.

Chapter 4

The distribution pattern of the two types of fibres as well as the activity of the various enzymes such as cytochrome oxidase, succinoxidase, malic oxidase, lactic dehydrogenase and lipase were studied in the different layers of the pigeon breast muscle. All the enzymes studied were found to vary in the different layers depending on the variation in the ratio of the distribution of the two types of fibres. The results indicate that the metabolically most active centres lie in the interior of the muscle where the narrow fibres are the highest in number and the broad fibres the least and that the fibres towards the periphery of the muscle show a poor capacity for respiratory metabolism. From the statistical analysis of the results obtained for the different layers, the activity of the various enzymes is derived for the fibre types with the help of the regression line, without actually having to isolate the fibres and the possibility of extending this method for other biochemical determinations in this muscle, is suggested. The values derived for the individual red as well as white fibres indicate that the major bulk of all the enzymes studied resides in the red fibres whereas the white fibres too possess these enzymes but in very low concentrations. The distribution pattern of the two types of fibres and their associated inclusions in a definite fashion indicate the mechanical and physiological efficiency of this muscle.

Chapter 5

The distribution and localization pattern of certain

DPN-linked dehydrogenases (malic, lactic, D-glucose, glutamic and a-glycerophosphate) were demonstrated histochemically in the red and white fibres of the pigeon breast muscle using NT as the hydrogen acceptor. All the dehydrogenases studied showed distinctly higher enzyme activity in the narrow red fibres than in the broad white fibres. a-glycerophosphate dehydrogenase was however found to be appreciably more in the broad fibre compared to other dehydrogenases in the same fibre. A high concentration of aldolase which forms an important link in the chain of enzymes in glycolysis was histochemically demonstrated in the broad white glycogen-loaded fibres.

Chapter 6

The localization and distribution pattern of cytochrome oxidase and the various dehydrogenases (succinic, malic, lactic, D-glucose, glutamic and a-glycerophosphate) were studied histochemically in the pectoralis major muscle of the rosy pastor, goose and fowl. The rosy pastor muscle showed a very high concentration of these enzymes as compared to the goose and fowl muscles. The goose though a poor flier but with the mixed type of muscle showed a higher concentration than that in the fowl.

Chapter 7

SDH was estimated quantitatively in the pectoral muscles of a few representative types of birds exhibiting various modes of flight and a bat for comparison. In all the birds and the bat the pectoralis major muscle showed higher enzyme activity than the pectoralis minor which shows that of the two, the former muscle is metabolically much more active and highly evolved. The pectoralis major muscle of the rosy pastor, sparrow, bat, parakeet and pigeon showed higher concentrations of SDH as compared to the other birds studied whereas the fowl, a nonflier, showed the least enzyme concentration. In the birds studied a reciprocal relationship was found between the enzyme activity of the pectoralis major muscle and the body weight, fibre diameter and weight of the pectoralis major muscle.

Chapter 8

Lipase and SDH activities were determined of the whole homogenate as well as the particulate fractions of the pigeon breast muscle. The soluble fraction showed the highest lipase activity whereas the mitochondrial and microsomal fractions showed nearly half the activity of the soluble fraction in each case. The specific activity of lipase, however, was found to be maximum in the microsomes. SDH was found to be mainly confined to the mitochondrial fraction. The microsomal and soluble fractions showed almost negligible concentration of this enzyme. The significance of the presence of lipase in the diffferent fractions is discussed in relation to the breakdown and the biosynthesis of neutral fats.

Chapter 9

Oxidation of two triglycerides, tributyrin and triolein using different concentrations was tried in vitro by the pigeon breast muscle mitochondria as well as the whole homogenate. Both the triglycerides used inhibited malate oxidation and were not oxidized under the conditions of the method used. Tributyrin at a final concentration of 1 µM, however, was not found inhibitory to malate oxidation when the whole muscle homogenate was used. The high lipase activity in the mitochondria indicate that neutral fats are not oxidized directly but only after hydrolysis.