SUMMARY AND CONCLUSIONS

Chapter 1.

Disuse atrophy in the breast muscle of the pigeon was induced by applying a plaster cast on the wings, which were kept in a dorsally extended position. Lipolytic activity in the breast muscle and blood serum was determined at different intervals from 1 day to 60 days. A higher enzyme activity in the muscle and a corresponding fall in the enzyme activity in blood serum were observed during the first week of atrophy. Fat and water content in the muscle were also estimated. During the first two weeks there was an increase in the water content of the muscle. A sudden increase in the fat content was observed on the first day of atrophy. Later the fat content gradually decreased and by the end of two months the fat content was found to be less than that in the normal pigeons. The physiological significance of such changes in lipase activity and fat content is discussed.

Chapter 2.

Quantitative changes in the succinic dehydrogenase activity of the pigeon pectoralis under disuse muscular atrophy varying from 1 day to 60 days were determined. The enzyme activity of the muscle was found to be decreasing from the first day itself. The lowest level in the enzyme activity was found to be after 7 days of immobilization. The physiological significance of the decrease in SDH activity is discussed.

Chapter 3.

Changes in the glycogen and phosphorylase levels in the atrophied pigeon breast muscle was studied at varying periods from 1 day to 60 days. A drastic fall in the glycogen content of the muscle was immediately observed after the first day of immobilization of the breast muscle. A corresponding change in the phosphorylase activity was very negligible. After 7 days of immobilization a sharp fall in the enzyme activity and glycogen level was observed. Thereafter the enzyme level gradually rose up without any significant rise in the glycogen content.

Chapter 4.

The effect of exercise on the free fatty acid levels in the muscle, liver, adipose tissue and blood in the pigeon was quantitatively studied by electrically stimulating the breast muscle. A reduction in FFA in the blood plasma, liver and adipose tissue was observed after 30 minutes of electrical stimulation of the muscle. In the muscle on the other hand an increase in the FFA content was noticed. It was observed that there is high rate of FFA extraction by the muscle from the blood which in turn is being supplied with fatty acids from the adipose tissue and liver during the activity of the muscle. From the data obtained it is concluded that the skeletal muscles of birds utilizes mainly fat during sustained muscular activity. The physiological importance of FFA as substrate for muscular activity is discussed.

Chapter 5.

A study on the effect of exercise by electrical stimulation of the muscle on the phosphorylase and succinic dehydrogenase levels in the pigeon breast muscle has been carried out. A highly significant increase in the activity of both the enzymes was observed. It is shown that during muscular activity the enzyme systems in vivo are operating at a considerably high rate to cope up with the greater metabolic activity of the muscle. The importance of the enhanced activities of these enzymex systems is discussed.

Chapter 6.

Lipase activity in the blood sera of three representative birds e.g. a non-flying bird (domestic fowl), a good flier (pigeon) and a migratory bird (Rosy pastor) has been studied. The highest concentration of the enzyme was obtained for the Rosy pastor blood, next for that of the pigeon and the least for the fowl blood. The physiological significance of the variation in lipase activity in the bloods of the three birds studied is discussed.

Chapter 7.

Phosphorylase activity in the red and white fibres of the pigeon breast muscle was determined by an indirect method based on the distribution pattern of the two types of fibres. The enzyme concentration was found to be higher in the superficial layers, where the broad white fibres are the maximum and lower in the deepest layers where the narrow red fibres are the

maximum.

A comparative study of the enzyme activity in the whole breast muscle of certain other birds e. g. Rosy pastor, Myna, Fowl and a bat was also carried out. From the results obtained it is found that the concentration of the enzyme is indicative of the state of activity of the muscle and is not necessarily an index of the nature of the fuel utilized for energy by the muscle concerned.

Chapter 8.

The lipid content and lipase activity in the breast muscle of the Rosy pastor (Sturnus roseus) in the different months from December (post-migratory) to April (pre-migratory) were determined. It was observed that there was a gradual increase in the body weight and muscle fat with a corresponding loss in the water content of the muscle. Total body fat during the pre-migratory period was found to be nearly 1/4 of the body weight. There was not much change in the lipase activity of the muscle except for a slight decrease during the pre-migratory period. The physiological significance of fat deposition in the muscle as a metabolic adaptation has been discussed.

Chapter 9.

The glycogen content and phosphorylase activity in the breast muscle of the migratory starling, Sturnus roseus was determined in the post-migratory (December) and pre-migratory (April) periods. It was observed that there is an increase in both glycogen content and phosphorylase activity towards the end of the pre-migratory period. The increase in

the glycogen content of the muscle was associated with an increase in the phosphorylase activity also. From the results obtained it is suggested that in this migratory bird there is an active glycogen metabolism which in turn promotes greater fatty acid synthesis through increased production of acetyl-CoA.

Chapter 10

Studies on the capacity for fatty acid (butyrate) oxidation by the breast muscle homogenate of the migratory starling Sturnus roseus in the post-migratory and pre-migratory periods were carried out. It was observed that the oxygen uptake due to the added butyrate in the manometric system during the pre-migratory period was considerably lower than that in the post-migratory period. During the pre-migratory period there was more oxygen uptake due to malate oxidation than in the complete system for fatty acid oxidation. The significance and importance of a diminished capacity for fatty acid oxidation in the pre-migratory period is discussed.

Chapter 11

The lipase and SDH activity in the various subcellular particulate fractions of the breast muscle homogenate of the migratory starling (Sturnus roseus) in the post and pre-migratory periods were determined. Diurnal changes in the enzyme activities of the different particulates were also determined in both the periods.

Significant differences in the activities of both

the enzymes in all the fractions as well as the whole homogenate of the muscle were observed. During the post migratory period lipase and SDH activity of the homogenate in the evening was higher than that of the morning, whereas in the pre-migratory period it was more in the morning. In both the periods the enzyme activity in the myofibrillar fraction was high in the evening except for lipase in the pre-migratory period. Mitochondrial fraction showed a higher level of enzyme activity in the post-migratory period. The microsomal lipase activity was very high in the evening during the post-migratory period, but in the pre-migratory period it was low in the evening and high in the morning. The SDH activity of the microsomes was high in the evening for the post-migratory period and low in the evening for the pre-migratory period. Most striking differences were seen in the lipase activity of the soluble fraction. In both the periods it was high in the evenings, but a considerable decrease was noted in the premmigratory period both in the evening as well as morning. In the post-migratory period the per centage recovery of lipase was higher than that of SDH whereas in the pre-migratory period the per centage recovery of lipase was lower than that of SDH while SDH recovery was not much affected. The soluble fraction contained highest concentration of lipase in the post-migratory period whereas in the pre-migratory period the microsomal fraction contained the highest concentration of lipase. The physiological significance of these seasonal and diurnal

changes in the enzyme activity in the various fractions, in the synthesis of fat during the pre-migratory period is discussed.