SUMMARY AND CONCLUSIONS

Chapter 1

The fibre diameter and enzyme content were studied in the flight muscles of butterflies exhibiting various capacities for flight. The flight muscles of the better fliers are composed of narrow fibres, while those of the poor fliers are composed of larger fibres. The fibres in any one muscle are uniform with regard to the size and the content of a few enzymes studied, viz. lipase, acid and alkaline phosphatases, ATPase and succinic dehydrogenase.

Quantitative estimation of lipase activity in the flight muscles of different butterflies showed a remarkable relationship with the insect's ability to fly and the concentration of lipase in its flight muscles. Good fliers are equipped with larger quantities of lipase than are poor fliers. It is suggested that, like birds and locusts, butterflies also utilize fat for energy during sustained flight.

Chapter 2

The fibre diameter of the flight muscles of a few moths was determined. The following enzymes were histochemically detected in the flight muscles of the moths examined: lipase, acid and alkaline phosphatases, ATPase and succinic dehydrogenase. The distribution of the enzymes was found to be more or less uniform in

the muscle fibres. Quantitative determination of lipase revealed a marked difference in the various species studied. The results obtained provide further support to the view that moths also utilize fat for energy during muscular activity.

Chapter 3

A study of the histochemical reaction of lipase alkaline phosphatase, acid phosphatase, ATPase and succinic dehydrogenase in the prothoracic and mesometathoracic muscles of the beetle revealed that these two types of muscles differ in physiological activity. The meso-metathoracic muscles which are the fibrillar flight muscles, showed a higher concentration of lipase, succinic dehydrogenase and the three phosphatases studied. The fibrillar flight muscle fibres are considerably larger in diameter compared with the prothoracic muscle fibres.

Chapter 4

A quantitative study of lipase and succinic dehydrogenase activities in the thoracic muscles of the beetle confirmed the histochemical observations of these enzymes. The fibrillar muscles of the meso-metathorax which bears the functional wings, have greater potential capacity to break down fat into fatty acids and glycerol and further oxidation of the fuel for energy. The higher SDH activity of the flight muscles is suggestive of a high aerobic metabolism in these muscles.

Chapter 5

Lipase and SDH activities were determined of the whole homogenate as well as the particulate fractions of the beetle flight muscle. Maximum recovery was obtained in the soluble supernatent fraction. Microsomal and mitochondrial fractions showed nearly half the activity of the soluble fraction . SDH was found to be mainly confined to the mitochondrial fraction. The microsomal as well as the myofibrillar and nuclear fraction also showed some activity. The significance of the distribution pattern of lipase in the difference fractions is discussed in relation to the breakdown and synthesis of fat.

Chapter 6

A quantitative determination of lipase activity in the different thoracic segments of the cockroach revealed that the metathoracic muscles possess the highest lipase activity among the thoraic muscles. A vast difference in the male and female sexes was observed for lipase activity.

Chapter 7

The slow and fast contracting leg muscles of the cockroach were examined for its lipase and SDH quantitatively. The slow contracting leg muscles contained considerably more of these enzymes than those in the fast contracting leg muscles. The higher concentration of lipase and SDH can be correlated with their higher lipid content and greater capacity to reduce methylene blue.

Chapter 8

The localization of lipase, SDH, cytochrome oxidase, acid and alkaline phosphatases, ATPase and glycogen was studied in the slow and fast contracting leg muscles of the cockroach histochemically. All the above mentioned enzymes and glycogen were found concentrated more in the slow contracting red muscle than those in the fast contracting white ones. The significance of the higher concentration of these enzymes and glycogen in the slow red muscle has been discussed and can be related to the sustained contractions of the slow muscle.

Chapter 9

Certain biochemical properties of lipase in aqueous extract of ether-defatted dry flight muscles of the cockroach was studied in a manometric system, using tributyrin as substrate. No cation requirement for the enzyme activity could be demonstrated. Sodium taurocholate inhibited the enzyme. ATP, cysteine and glutathione were found activating the enzyme. PCMB and $HgCl_2$ were both highly inhibitory. The inhibition by PCMB was reversed completely by the addition of glutathione. 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 10

A quantitative study of SDH in the muscles of a few representative types of insects revealed that the flight muscles are very much active for this enzyme than the leg muscles of the same insect. It was found that the concentration of SDH is considerably more in the flight muscles of insects when compared with that of the flight muscles of birds. It is suggested that insect flight muscles are adapted for aerobic metabolism. Much difference was not obtained between those insects which utilize fat and carbohydrate as chief fuel.

Chapter 11

The in vitro study of lipase activity and butyrate oxidation in the honey bee flight muscle homogenate revealed that this muscle contains a lipase and the capacity to oxidize butyrate exists in this muscle. It was observed that the rate of butyrate oxidation is related to the intensity of activity of the flight muscles.

Chapter 12

A brief account of the different histological types of insect muscles is given. The activity of the muscles, their metabolic rate, the types of fuel utilized for enrgy during flight and certain other related topics are discussed under the title of 'Some general considerations'.