SUMMARY AND CONCLUSIONS

Chapter 1

The pectoralis major muscle of the pigeon contains a true lipase, which has an optimum pH at 8. The enzyme shows only slight activity at temperatures below 15°C. The optimum temperature for long period of incubation is 40°C. It is found to be highly stable between temperatures 40°C and 60°C. The activity of the enzyme at different periods of incubation and at various concentrations is presented. The activity on the different substrates studied has the order tributyrin > triacetin > castor oil > olive oil. The lipase value of the pectoralis major muscle of the pigeon is estimated to be 8.5. The occurrence of lipase is also noted in the breast muscle of the bat and fowl and the leg muscle of the fowl and frog. The lipase values obtained for these muscles are 11.0, 1.0, 1.1, and 0.8 respectively. The significance of the occurrence of lipase in muscles is discussed.

Chapter 2

The lipase value of the heart muscle of a number of vertebrates is determined. It is found that the heart lipase value in different animals vary according to size, sex, age and activity. In rat and sparrow the males have lipase value higher than females. In rat, lipase value of the heart is highest during the period of maximum growth. These changes in the lipase activity of the heart muscle is correlated with metabolic rate. The significance

of the high concentration of lipase in the heart muscle is discussed.

Chapter 3

Using "Tween 80" as substrate, the presence of a true lipase in the heart muscle of the pigeon and the pectoralis major muscle of the dove, kite, parakeet and bat is demonstrated. In the pigeon, dove and bat the enzyme is confined to the narrow fibres while it is uniformly distributed throughout the muscle fasciculus in the kite and parakeet. The muscle lipase is destroyed by acetone fixing. A simple method for cutting fresh frozen sections of tissues is described.

Chapter 4

Certain biochemical properties of lipase in aqueous extract of an ether defatted dry powder of the pigeon pancreas are studied in a manometric system using tributyrin as substrate. No cation requirement for the enzymic activity could be demonstrated. This enzyme is activated by sodium taurocholate and is inhibited by Krebs cycle intermediates and lactic acid. This lipase is activated about 600% by $HgCl_2$ at very low concentrations of the salt and is inhibited by PCMB and $HgCl_2$ at higher concentrations. The enzyme solution does not contain -SH or even sulphur in its protein and still behaves as if it is a sulphydryl enzyme in the presence of sulphydryl reagents. The enzyme appears to be a metallo-protein or a protein requiring metal and reactive NH_2 groups for its activity. The metal most probably is iron.

Chapter 5

Certain biochemical properties of the pigeon breast muscle lipase are studied and compared with those of the pigeon pancreatic lipase. No added cation requirement could be demonstrated for the activity of this enzyme. The enzyme is inhibited by sodium taurocholate and activated by intermediate metabolites at low concentrations. $HgCl_2$ and PCMB inhibited this enzyme. The enzyme solution does not contain -SH or -S-S- groups in its protein. This enzyme, like the pancreatic lipase , appears to be a metallo-protein requiring reactive NH_2 groups for its activity and is believed to be identical with the pancreatic lipase.

Chapter 6

The properties of the rat heart lipase are compared with those of the pigeon pancreatic and breast muscle lipase. The activity of this enzyme is not dependent on any added cation or heparin. In all other respects also this enzyme very much resembles the pigeon breast muscle lipase. It is claimed that this enzyme and the "lipoprotein lipase" of literature are one and the same and is identical to the pigeon pancreatic and breast muscle lipase.

Chapter 7

The oxidation of triglycerides of butyric and oleic acids and their respective sodium salts by pigeon breast muscle mitochondria is studied in a manometric system. Triolein is oxidized at a much faster rate than any of the other substrates. It is suggested that during the katabolism of glycerides in

muscle tissues, β oxidation of the long chain fatty acids takes place first and hydrolysis by lipase takes place only when the carbon chain of the fatty acids is reduced to 2 or 4. The slow rate of oxidation of tributyrin is explained as due to the predominance of lipolysis and the consequent rapid fall in the pH of the reaction mixture. The effect of carbo - hydrates and the intermediates of their metabolism on the oxidation of fat is discussed. It is suggested that in muscles which utilize fat as chief fuel for energy, fatty acids are oxidized in preference to glycogen and glycolysis is resorted to only when oxygen is deficient. The lipolytic activity of the mitochondria is found to be 14.6 μl CO_2/mg. protein/hr. on the average.

Chapter 8

Certain dehydrogenases in the breast muscle of the pigeon, bat and fowl and the leg muscle of the fowl and frog are studied histochemically by the use of TTC. The dehydrogenase activity is found to have a relationship with the diameter, colour and the mitochondrial content of the individual muscle fibres. In the pigeon breast muscle however, the broad white fibres do not show the presence of any of the enzymes studied. It is therefore concluded that these fibres in the pigeon breast muscle are a unique system in which none of the oxidative processes concerned takes place; they cannot be considered as analogous to the white fibres of the other muscles studied.

Chapter 9

The alkaline phosphatase activity of the breast muscle of the pigeon and bat is histochemically studied using the Gomori technique. The distribution of this enzyme in the individual muscle fibres follow the concentration pattern of oxidative enzymes and is therefore related to activity.

Chapter 10

An evaluation of the metabolic efficiency of the red and white fibres in vertebrate skeletal muscles especially the breast muscle of the pigeon is made and its relation to the energetics of muscular activity discussed.