SUMMARY

CHAPTER I

The materials and various methods employed for the present investigations are outlined in this chapter.

CHAPTER II

Morphometric and gravimetric studies were carried out in the chicks of domestic fowl, *Gallus gallus domesticus* (RIR variety) and in chicks of Japanese quail, *Coturnix coturnix japonica* during the first 30 days of growth and after attainment of adulthood (22 weeks and 7 weeks respectively). Studies were also extended to certain other adult birds *viz.*, swift (*Apus affinis*), house sparrow (*Passer domesticus*) and blue rock pigeon (*Columba livia*). In the developing birds there was a significant increase in the body weight, absolute weights of proventriculus and ventriculus and even in the intestine length and weight. Also an increase in the size of the structural elements of the proventriculus and ventriculus was noted. The allometric growth of the proventriculus, ventriculus and intestine during development, is in response to their functional adaptations at different days of posthatched development. The data presented here suggest that the pattern of growth is guided by the reasons that are allocated at anytime to the growth of the components with the currently highest functional priority. Thus, if a comparison is made on the percentage of body growth, organ growth and allometric growth in these two avian species it was observed that the quail grew more rapidly than the fowl.

A much slower proventricular and ventricular growth was noted in the quail than in fowl till 30 days. These changes are discussed in detail in relation to the functional demands of the organs. In the adult altricial birds, correlating with the changes in the consistency of the food, corresponding changes in the size and thickness of the components of the organs were noticed which are for meeting the necessary functional requirements of these organs. Irrespective of differences in the type and consistency of food their relative weight remains little affected (except pigeon). The differences in the thickness of various structural elements of proventriculus and ventriculus of the adult birds were undoubtedly based on the type and consistency of food.

CHAPTER III

The dramatic changes in the concentration of metabolites and activities of enzymes involved in

carbohydrates, lipids and protein metabolism during the transitional period from foetal to neonatal stages in mammals and at about the time of hatching in the chicks are established facts. Birds are known to differ in their habits of selecting diets and these differences in diet should also reflect on the biochemical and enzymatic peculiarities. In order to corroborate this contention on metabolic profiles, studies were carried out in the stomach complex of two developing precocial birds and few adult birds with different dietary preference. It was observed that carbohydrate metabolism was noted to be a continuous process and the lipid catabolism appeared to be significant one during the later phase of development. It may, thus, be inferred that the stomach complex of these birds during the initial days of development though dependent upon carbohydrate also utilizes some amount of lipids. Moderate and uniform incidence of lipid catabolism in the stomach complex of adult birds appears to be reasonable and tenable as the stomach complex (particularly ventriculus) could be functionally associated with the process of slow and sustained contractility. Utilization of carbohydrate even to a low level seems justified from the fact that there is always a minimum level of catabolism but also from the fact that the stomach complex at times might have to engage itself in quick, tetanic mode of contraction to evacuate the contents into the duodenum.

CHAPTER IV

Myoglobin, a reddish brown muscle sarcoplasmic chromoprotein, though known to be present in skeletal and cardiac muscles, is lacking in smooth muscles with an exception in the stomach complex of birds. Myoglobin, if present in sufficient quantity is capable of taking over a substantial part of the burden of oxygen transport in the cells whenever the pressure of oxygen drops. It is responsible in large part for the colour of muscle and serves as a storage organ for oxygen and therefore important to metabolism of cell. The concentration of myoglobin in a muscle is generally regarded as an index of capacity of the muscle for aerobic metabolism. Such a corroboration is possible with respect to elevated levels of myoglobin in the proventriculus and ventriculus as these organs perform sustained activity. The elevated myoglobin concentration is related with the high capacity to deliver oxygen to the tissues and with the high oxidative metabolism and also to synthesize energy rich phosphate for the effective functioning of the organs.

CHAPTER V

In order to understand the oxidative metabolism in the stomach complex of the birds, a key enzyme *viz.*, ATPase was quantitatively assayed in the proventriculus and ventriculus in both the developing precocial species and the adult precocial and altricial birds. The data revealed that ATPase activity vary considerably during the developmental periods in both the birds. A possible conclusion at this juncture could be that the oxidative metabolism was adjusting itself to cope up with tremendous increase in the functional demands of both proventriculus and ventriculus and this energy demand is made available from ATP. And ATPase induced hydrolysis of ATP, could be an important feature in the normal functioning of these organs. The variations in the concentration of ATPase in the adult birds is justifiable and are discussed in detail in the chapter.

CHAPTER VI

Acid and alkaline phosphatases, the enzymes catalyzing the hydrolysis of phosphate esters, are reported to be present in a variety of tissues. Different functions are ascribed to these enzymes according to their distribution. Alkaline phosphatase is commonly associated with the absorptive and secretory activities of different organs while acid phosphatase is involved in phagocytosis, dissolution of tissue components, cellular differentiation and keratinization. Several scientists have reported that both these enzymes play an important role in protein synthesis also. Because of their ubiquitous and nonspecific nature, the phosphatases could readily participate in many of the adaptive changes taking place in the alimentary canal. Hence, it was thought desirable to study these two phosphatases histochemically and quantitatively in the stomach complex of the two developing precocial avian species and of certain other altricial adult birds. Acid phosphatase activity was ~~observed to be~~ high in the stomach complex of developing and adult birds, whereas the alkaline phosphatase activity remained low. The activity of the former in the stomach complex of adult birds was correlated with both the structural and functional aspects of the organs, whereas the activity of the latter has been interpreted with the function of laying down of connective tissue element and synthesis of contractile protein.