INTRODUCTION

Though the vertebrate skeletal muscle has been the subject of intensive research in the recent years our knowledge of its structure and function is still insufficient to form a basic understanding of the factors involved in the progressive degeneration of the tissue in muscular diseases. However, it is now being increasingly realized that a better knowledge of the heterogeneity of the cellular elements constituting a muscle is likely to take us nearer the goal. A voluntary muscle possesses two different types of muscle fibres, the white, tetanic and the red tonic. While the former ones are specialised for quick and short contraction the latter are for slow and sustained activity. The morphological difference is also associated with a metabolic diversity which together form the basis for the functional diversity. The white fibres utilize mainly glycogen for energy whereas the red ones depend largely on fat. The white fibres are therefore adapted more for an anaerobic metabolism whereas the red ones for an aerobic metabolism.

Muscular dystrophy in humans is a chronic disease of unknown etiology of the voluntary muscles. It is manifested by the gradual progressive wasting of the muscle and finally becomes fatal impairing the respiratory muscles. The present work is an attempt to evaluate some of the

biochemical and histophysiological alterations of the atrophied muscle induced by artificial means so as to elucidate and comprehend some of the etiological factors associated with human muscular dystrophy. The pigeon breast muscle which is a mixed muscle consisting only two types of fibres, the red and white, was considered as a useful experimental material for a series of investigations on induced degenerative changes.

Myopathy was experimentally induced in pigeons by immobilizing the wings applying a plaster cast, and by cutting the brachial plexus. Hisological, histochemical and biochemical investigations were carried out on the atrophic muscle at regular intervals upto 30 days. Simultaneously certain biochemical observations were also carried out on the blood.

The histochemical investigation on glycogen and phosphorylase has shown an increase in the glycogen content as well as phosphorylase activity in the red fibres. The histochemical observations of succinate dehydrogenase activity showed an increase in the white fibres and a decrease in the red. These studies have indicated a shift in the metabolism of the cellular components of the muscle as a result of atrophy.

Cholinesterase was studied histochemically in the immobilized pigeon breast muscle, with view to understand the nature of endplates during the period of progressive disuse.

The quantitative studies of the electrolytes, sodium, potassium and calcium carried out on the muscle and blood during the immobilization atrophy indicated alterations in their concentrations in accordance with their metabolic disturbance. in the muscle.

A biochemical study on the capacity of the muscle for fatty acid oxidation and its respiratory quotient during the progressive period of disuse atrophy, revealed the inability of the muscle to oxidize fatty acids along with a corresponding high R.Q. value. This seemed to suggest a diminished utilization of fat during the process of atrophy.

The above histochemical and biochemical studies were extended to the breast muscle of pigeons subjected to denervation of the brachial plexus. Changes in the concentrations of glycogen, fat, succinic dehydrogenase, β-hydroxybutyric dehydrogenase, glucose-6-phosphate dehydrogenase, 6-phosphogluconic dehydrogenase, Tween 20 esterase, Tween 85 lipase, alkaline and acid phosphatases studied histochemically were fonnd to be comparable to those induced by plaster cast atrophy except that the degeneration was considerably more rapid in the denervation atrophy. It was also noticed that the white fibres underwent degeneration at a faster rate than the red ones. These observations were supported by the quantitative study of the metabolite glycogen, and some of the enzymes concenned in metabolism.

A number of biopsy samples from human muscular dystrophic patients were studied histochemically and biochemi-

cally and compared with the findings of the degenerative changes in the pigeon breast muscle. Many of the basic changes occurring in the human muscle were similar to those observed in the pigeon breast muscle under atrophy. Those studies have also shown that the fundamental defect in the muscle is caused as a result of faulty metabolism of fat which tended to accumulate in the inter- and intra- cellular spaces of the muscle.

It may be pointed out here that this thesis has been prepared with the intention of publishing it in parts as separate papers and so each chapter has been prepared as individual pieces of work. This has inevitably resulted in some of the repetitions, which otherwise could have been avoided.