SUMMARY AND CONCLUSIONS

The present investigations were mainly carried out to understand the functional anatomy of the feeding and hind limb locomotor apparatus in two starlings belonging to the same subfamily Sturninae. The birds selected are *Acridotheres tristis* LINNAEUS and *Sturnus roseus* LINNAEUS. The studies conducted during the present investigation were mainly oriented towards the understanding of the following:

I. The food and feeding behaviour.

II. The epidermal structure of the bill and the tongue.

III. The feeding apparatus.

A. Osteology.
   a. The bony elements and the ligaments of the skull.
   b. The kinesis of the upper beak.
   c. The lever systems in the skull.

B. Myology
   a. The structure and disposition of the muscles.
   b. Quantitative myology of the jaw muscles.

IV. The hind limbs locomotor apparatus.

A. Osteology
B. Myology
V. Histochemical Studies.

A. The jaw muscles
B. The leg muscles

I. Both the starlings are omnivorous in habit and feed upon insects, grains of cereal plants, seeds of grasses, fruits, nectar and any other food available. Occasionally they exhibit even carnivorous mode of feeding. The study of their food and feeding behaviour has revealed that their consumption of various foods differs. Acridotheres prefers insect food to the plant diet whereas Sturnus is mainly a grain and fruit eater.

II. The epidermal structures of the bill and the tongue are ideally suited for their preferred feeding habits. Acridotheres exhibits comparatively homogeneous epidermal structures of the tongue and the buccal cavity as it feeds mainly on insect diet. In Sturnus the hard palate bears three very prominent palatal boss which reflect their higher consumption of grains and seeds.

III. While the basic structure of the skull remains the same except for the relative size, the structures and ratios of different bony elements are indicative of their characteristic feeding behaviour. The thin but strong skeletal elements are suited for their omnivorous feeding habit; but the ratios for
the quadrate and the postarticular process differ in two birds with regard to their feeding mechanisms. The longer orbital process of the quadrate in Sturnus serves as a factor contributing to the greater mechanical advantage required for their seed eating habit while relatively large postarticular process in Aeridotherees provides a better leverage for the gaping mechanism. Broad tips of these processes provide a larger surface area for the origin of the massive muscles in the respective birds. Kinesis and mechanical advantage obtained in these birds also reflect upon their feeding behaviour.

The muscles operating the feeding apparatus are grouped according to their functions into - the adductors and abductor of the lower jaw and the retractors and protractors of the upper beak. Structure and disposition of these muscles evince that they are developed according to the functional demands of these birds. Aeridotherees which gapes frequently on acil has developed powerful abductor as well as protractor muscles. The M. Depressor mandibulae is strikingly large in this bird. The M. Spheno-˥ предостygo-quadratus is also a massive muscle with a very broad origin. These two muscles in Aeridotherees indicate a powerful gaping action in this bird. On the other hand, the M. Pseudotemporalis in Sturnus is a highly massive muscle indicating a powerful adduction of the lower jaw.
Quantitative analyses of the jaw muscles justify the relative developments of the abovementioned muscles. The effective force of abduction is greater in Acridothères.

Though the effective force of abduction by the adductor series is higher in Acridothères, the total effective force of abduction is greater in Sturnus simply on account of its powerful addective force exerted by the M. Pseudotemporalis. The other two forces — retractory and protractory forces — are greater in Acridothères in relation to its high gaping action required.

IV. The hind limb locomotor apparatus in these birds show adaptations to an efficient bipedal gait required for their terrestrial existence. While feeding, these birds have to run short distances also and for balancing the body in this type of locomotion the skeletal elements of pelvis as well as hind limbs have undergone some structural adaptations. The wide pelvic girdle which keeps the legs well apart is the adaptation to their walking and running gait. Elongation of hind limb elements, viz., femur, tibiotarsus, and tarsometatarsus, are suggestive of the speed with which these birds can move. The anisodactyl arrangement of digits in the feet indicate their walking and perching habits. Elongation also of the hallux and the third digit can be accounted as adaptations to walking and perching habits. Besides, the
elongation of tibial region the structural peculiarities such as wide condyles are associated with the bearing of body weight while standing, walking and perching. Further, the well developed cnemial crests reduced trochanteric ridge and fibula also contribute towards the better locomotor behaviour.

The shape and placement of the leg muscles is such that they are ideally suited for the bipedal gait. The muscles grouped according to their main actions in moving the different bony elements, of the leg are studied and comparison of these muscles performing different functions are described. In performing these functions several muscles act either synergistically or antagonistically to produce an intrinsic balance, resulting in various degrees of movements of the hind limbs. It is also true that one muscle functions in more than one way and contributes in the movements of two parts concomitantly.

The relative development of the leg musculature to the body weight and the development of individual muscles to the leg musculature indicate the functional capacity of the hind limbs and individual muscles in bringing about different movements in locomotion. The M. Gastrocnemius is the largest among the whole leg musculature because it is involved in the major movements of the leg. The M. Femorotibialis, situated
in the thigh region is the second largest muscle and most simple in its action of extending the tibiotarsus. The antagonist muscles of these two muscles are also well developed. Among the other muscles the flexors of the toes are remarkably developed in these birds which can be correlated to their terrestrial and perching habits.

V. Histochemical organization of the jaw and leg muscles reveal that these are "mixed muscles" with more or less equal distribution of the two fiber types which are referred here broadly as type I and type II. This may be explained in view of the fact that these omnivorous birds require neither a sustained muscular power nor a quick action and therefore, do not exhibit either predominant aerobic or predominant anaerobic metabolic activities.

With regard to the histochemical profiles of the muscle fibers it is observed that the relationship of the fiber type to their diameter and speed of contraction is not constant and their "reciprocal relationship" is not very evident. The present study of different histochemical attributes indicates that the muscle fiber is a dynamic cell and changes in its physiological properties to the functional demands. The "mixed" muscles in the birds studied here are capable of utilising both the aerobic and anaerobic metabolisms and
thereby meet with the functional demands of these birds. In this respect also, these birds are very well adapted to their feeding, perching as well as locomotor behaviour.