GENERAL INTRODUCTION
Air and water are fluid media and animals moving through them have similar problems. They do not have a solid substrate to support their weight, and the forces needed to make them move are exerted against a medium that virtually slips away. Air is much less dense and viscous than water, a difference that has substantial effect on animal locomotion in the two media but there are many fluid dynamics principles in common.

Differences in the physical quantities of the media in which animals move have a profound effect on structural adaptations. The weight of most swimming animals is fully supported by the surrounding medium but running and flying animals must support the full weight of their bodies. The running animal has a solid support, but the flying animal must support its weight against a fluid of low density and low viscosity. In contrast, then the aquatic animal swims through water, it meets resistance of a medium of high viscosity and density; running and flying animals have the advantage of moving in a medium of low viscosity and low density.

An animal swimming through water meets with resistance, or drag, and to propel itself the animal must supply a force which equals the drag. The drag on an aquatic animal is a complex function of shape, size and speed. The importance of
shape is expressed in what is commonly known as "stream lining" so well known from fish and whales and regrettably absent in birds. If an animal that salad is heavier than the water, part of its energy expenditure goes to keep from sinking, and only part is available for swimming. The problem of buoyancy is more important for large than for a very small animals; small animals have a larger relative surface area that reduce sinking rate in water.

Swimming is in principle not too different from flying through air, except that the higher density of water reduces the power needed for providing lift. For large animals, the drag increases roughly in proportion to the square of the speed and this puts severe limits on the attainable speed (Lighthill, 1974). It is interesting to note in this context that how some of the largest and predatory fishes have developed means of keeping their power plant, the muscle mass, at a high temperature, so that maximum power out put is possible.

The regular relationship between body size and metabolic rate of the animal is now very well recognized (Schmidt-Nielsen, 1979). The rate of oxygen consumption per gram decreases consistently with increasing body size. This tremendous increase in oxygen consumption of the small animal necessitates that oxygen supply and hence the blood flow is
much more greater compared to the larger animals, one may expect other physiological variables between small and larger animals.

Birds exhibit great versatility in locomotion, some are runners, some waders, and the rest flyers. Of these, some can perform only one type of locomotion, some two, and other all three, with of course restricted efficiency. In recent years considerable amount of work has been done on the energetics of flight in birds (Fisher, 1955; George and Berger, 1966; Alexander, 1977 and Farmer, 1975) and aerodynamics of birds flight is presented by Brown (1961). However, the survey of the literature revealed that the knowledge on the energetics of swimming in birds is limited and fragmentary.

Similar to their successful acquisition of air, some species of birds have also adapted very well to aquatic mode of life. It could then be anticipated that these birds should have undergone evolutionary readjustments in their altered environment in certain tissues in respect of their metabolic activity. The most obvious metabolic adaptation seen would be in the muscle tissue. It is known from the studies on diving mammals that they generally exhibit a series of physiological adjustments (Scholander, 1940; Irving et al., 1947; Scholander et al., 1942a), George and his associates (George and Ronald, 1972; 1973; Vallyathan et al., 1969; George et al.,
1971) have provided useful information of skeletal muscles of harp seals, a diving mammal. The energy metabolism of a domestic duck during diving was greatly depressed has also been shown by Anderson (1950).

In the light of these observations, it would be rewarding to compare the metabolic adaptations of certain appendicular muscles of phylogenetically aquatic birds; the dabchick (rallina eurica), the coot (fulica atra) and the domestic duck (anas platyrhynchos). The reasons for choosing these three birds have to be stated at the outset.

In the first place most of the birds studied so far are only good fliers and in many instances they are migratory. The birds however, selected for the present investigation exhibit great versatility in their locomotory behaviour.

Secondly, these birds offer a study in contrast, since the dabchick and coot are active waders as well as fliers, whereas the domestic duck due to domestication is more of walking bird and has virtually lost ability to fly.

Thirdly it is hoped that this investigation would give useful information on the fuel metabolism of birds with different body size, since it is known that there is a regular relationship between body size and metabolic rate. For example;
<table>
<thead>
<tr>
<th>Species</th>
<th>Size</th>
<th>Weight (gm)</th>
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<tbody>
<tr>
<td>Pedicope roticollis</td>
<td>small</td>
<td>100 to 200</td>
</tr>
<tr>
<td>Fulica streata</td>
<td>medium</td>
<td>300 to 700</td>
</tr>
<tr>
<td>Anas platyrhynchos</td>
<td>big</td>
<td>1050 to 1250</td>
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Finally the investigation offers the opportunity to review the biochemical adaptations of birds which exhibit variety of locomotory behaviours.

Based on the above considerations, the various facets of this investigation have been grouped in four parts as outlined below.

**Part I**

Comparative studies on the morphological disposition of certain appendicular muscles of dab chick, coot and domestic duck.

**Part II**

Myoglobin content and fuel reserves of certain appendicular muscles of dab chick, coot and domestic duck.

**Part III**

Fibre profile and enzymatic histochemistry of certain
dehydrogenases in the appendicular muscles of dab-chick, 
coot, and domestic duck.

**Part IV**

Biochemical properties of certain appendicular 
muscles of dab chick, coot and domestic duck with reference 
to lipid utilization and some enzymes of concentrations.