INTRODUCTION

It is now well established that long term demands for energy in various tissues are met through the oxidation of lipids, though in the initial stages the immediate source of energy is obtained through glycolytic metabolism. This has been well documented in the case of active flight muscles of birds and bats (George and Jyoti, 1953, 1955 & 1957; George and Scaria, 1956; George and Talesara, 1960, 1961 a & b, 1962; George and Vallyathan, 1964 a, b & c; Vallyathan, 1963), cardiac muscle (Bing, 1956; George and Iype, 1959 & 1963; George and Scaria, 1957), mammalian diaphragm (George and Susheela, 1961) and insect flight muscles (Weis-Fogh, 1952, George and Bhakthan, 1960 & 1963). The present studies were undertaken in order to ivestigate the possibility of lipids being the source of energy for spermatogenetic activity. Since it is well known that the male albino rats are sexually active throughout the year and their testes continuously produce the sperm cells, these animals were selected for the present study.

As a pre-requisite to an understanding of the lipid metabolism in the rat testis, the occurrence, precise localization and distribution pattern of lipids and lipase, an enzyme primarily essential for lipid degradation, was studied histochemically. Having established that lipids as well as lipase is present in the interstitial tissue and all the cells of the seminiferous tubules, it was thought necessary to find out

whether certain oxidative enzymes such as β-hydroxybutyric dehydrogenase and succinic dehydrogenase, concerned with the oxidation of fatty acids, are also present in the rat testis. In order to obtain information regarding general oxidative activity the following enzymes were also studied histochemically : Lactic dehydrogenase and Malic dehydrogenase. In addition to this the phosphatase activity, both at acidic as well as alkaline pH range, was studied with a view to understand the general phosphate flux, and the functions of the phosphatases in the processes such as intermediary metabolism and transport of metabolites across the membrane barriers involving absorptive and secretory mechanisms.

It is well known that spermatozoa are formed in the seminiferous tubules and that their further maturation takes place in the epididymis. Some morphological changes; like the migration of kinoplasmic droplet, down the head and the mid-piece of the spermatozoa, increase in the density of the sperm nucleus; are known to occur as the spermatozoa pass through the epididymis. The ejaculated spermatozoa are better capable of effecting proper fertilization of the mature ova than those directly obtained from the testis. In addition to this, it is also known that spermatozoa are maintained in the epididymal duct for considerably longer time without the loss of motility and fertilizing potentiality. In the light of these observations it is logical to assume that the spermatozoa undergo certain

subtle changes during their sojourn in the epididymis and that the latter must be providing optimum conditions for maturation and storage of spermatozoa. It was, therefore, thought worth while to study the different parts of the epididymis of the rat. Such a study was undertaken by employing similar histochemical methods as applied in the study of the testis.

The functions of the male reproductive system are under the control of gonadotropins and are also influenced by the circulating sex hormones. These hormonal substances are known to induce some morphological as well as physiological changes brought about by alterations in the biochemical processes at enzymatic levels. A study of lipid metabolism in the testis would be inadequate without a knowledge of the hormonal influences. An attempt was, therefore, made to study the effects of gonadotropins and testosterone propionate on the lipid content and the levels of lipase and SDH activities in the rat testis and caput and cauda regions of the epididymis.

It is known that during the developmental stages of organs, there occur important biochemical changes at the enzymatic levels in preparation for attainment of specific functions at the adult stage. It was, therefore, thought desirable to study the levels of lipids, lipase and SDH in the rat testis during the post-natal development.

Rats are known to breed throughout the year, and information obtained in such a case might be different from that concerning other seasonally breeding animals. It was, therefore found necessary to study the testes of, at least, few other vertebrates in order to obtain some general and comparative information. The occurrence and distribution of lipids and the lipase activity in the testes of a few locally available vertebrates were, therefore, studied. In this series of animals was also included a migratory starling - Rosy-Pastor (Sturnus roseus), collected during the pre- and post-migratory periods.

It was noticed that the mediastinal rete testis of seasonally breeding mammals presented certain interesting features. The rete testis is generally described merely as a passage for the spermatozoa from the testis to the epididymis. It appeared that this tissue does not act merely as a passage but might well have an active role in the system. This tissue, therefore, was reinvestigated histologically, and was also studied histochemically to explore the above possibility.

While attempting to extend the investigations to the epididymis of the rabbit it was observed that there is a distinctly different and comparatively very wide region in the duct system of the epididymis, which has its inner epithelial lining produced into many branching and anastomosing

folds. This strickingly different region of the rabbit epididymis was studied histologically as well as histochemically. This region was found to be confined to the cauda epididymis, which has been homologized here with the ductus aberrantis.

On the basis of certain observations made during the course of the present work, it was assumed that probably certain pre-synthesized lipid components are transported by the Sertoli cells to the germinal elements during spermatogenesis. Recently Bieri and Prival (1965) have brought forth evidence to show that the rat testicular lipids maintain a specific fatty acid pattern, particularly in the case of the 22-carbon-polyunsaturated fatty acids; and even a wide variation in the ingested fatty acids could not alter this to any considerable extent. In the light of such observations it is logical to assume that such a lipid specificity must have some important bearings on the process of spermatogenesis. Such maintenance of the chemical environment may probably play a role in minimizing the fluctuations at the site of spermatogenesis, where, precise genetical information is to be passed down to the future generations through the spermatozoa. In order to test the validity of this assumption an attempt was made to study the incorporation of labelled acetate into the lipids.