Chapter - I

An Introduction to the Thesis

Algology is now rapidly emerging into an experimental life science. There is no single group of living organisms as heterogeneous in its constituents, in its cytological and physiological make up as 'algae' and hence these primarily photosynthetic organisms provide an excellent experimental material to probe into the molecular mystery of life-mechanics. Algae provide several exceptions to the set principles of physiology. On one hand we have some cyanophyceae which grow in virtually boiling water of thermal springs where all enzymes normally would cease to function and on the other hand we have algae growing in snow and arctic sea at below zero degree temperature where no normal organism on the earth can ever conduct normal physiological functions. Electron microscopy has also revealed that cell organization of various divisions of algae differ greatly from each other.

Blue green algae which were considered closer to green algae by earlier workers have now been proved to be prokaryotic in their cell organization. They lack mitochondria, chloroplasts, endoplasmic reticulum,
dictyosomes and such other cell organells which are definitely found in green algae. It was therefore thought to undertake a comparative study of these two interesting groups of algae viz. cyanophyta and chlorophyta.

Not to mislead from the immensity of the title "Comparative physiology" we should mention here that in order to avoid dispersion of information we have restricted ourselves to the study of some key enzymes and few important metabolites which we thought would give us useful clue to extend our future research. Some blue green and green algae are investigated here for activities of enzymes such as ascorbic acid oxidase, peroxidase, special peroxidase, catalase, amylase, aldolase, succinic dehydrogenase and urease. Algal cell though looks simple can no longer be considered as membrane bag with mixture of certain metabolites and enzymes. Modern cell biological research have given ample of evidences that multi enzyme systems are organized within the cell especially the cell membranes. Siekevitz, P. in 1959 at Ciba symposium (7) on meaning of Intracellular structures, pointed out that modern biochemistry should deal with integrated enzymic activity at cellular and subcellular levels of organization rather than with individual enzymes. We have not concentrated to study enzyme kinetics of a few enzymes but instead have tried to
get overall picture about the status of some oxidative and some hydrolytic enzymes in algae.

Though the algal cell is energy trapping and generating 'Factory', in it transformation of energy takes place at mild temperature at 25-37°C in dilute aqueous system of relatively low ionic strength, with narrow limits of pH and low electric potential differences. All these impossibilities of physical world are accomplished clearly because the enzyme systems of the cell have been beautifully engineered by organic evolution for the efficient and rapid energy conversions under mild isothermal conditions. Moreover there is excellent 'miniaturization' of cell machinery. The energy capturing and utilizing machines are truly molecular in their action and dimension. These molecular machines are comprised of assemblies of enzymes which are orderly arranged in the cell membrane (having semiconductor properties) according to their function and purpose. The steric and dynamic organization of these structured multienzyme systems is under exquisit control, in part by genetic mechanism and in part by complex network of feedback and other cybermatic systems. Thus the molecular machinery, - the enzyme system, has self-adjusting, self-preserving and self-reparation properties.
SCOPE OF THE PRESENT INVESTIGATION

In the present investigation some blue-green algae (Cyanophyta) and some green algae (Chlorophyta) were grown in pure cultures in laboratories. Growth behaviour of two unicellular forms has been studied. Algae have been investigated for their ascorbic acid metabolism. Oxidative enzymes such as catalase, peroxidase, special peroxidase and succinic dehydrogenase and other enzymes such as amylase, protease, aldolase, urease have been studied. Attempts have been made to interpret the data to elucidate taxonomic position of algae.

The thesis is divided into eight chapters. In the beginning of each chapter the subject is reviewed with the help of available literature, materials and methods employed are described with all details, experimental findings are recorded and data have been shown in tables and diagrams. Results are discussed in light of available information. At the end of each chapter bibliography is given.