INTRODUCTION

Germination is characterised by a rapid uptake of water which facilitates the mobilisation of reserve materials and the utilisation of these reserves for the growth of the embryo axis. The successive physiological events taking place, right from the imbibition of water up to full grown seedling with an autotrophic existence will thus include; (1) Breakdown of seed reserves, (2) A possible accumulation of the resulting intermediates - some of which in themselves are new and novel compounds and (3) utilisation of these intermediates in energy-yielding processes for the synthesis of new cell-constituents. Seed is generally composed of food storing organ - cotyledon or endosperm and the embryo axis. The catabolic processes concerned with breakdown of reserves occur in this storage organ whereas embryo axis has got all the potentialities to divide and grow, as it is the seat of anabolic or synthetic processes.

There are various enzymic systems as well as metabolites responsible for these catabolic and anabolic processes, ultimately leading to the growth of embryo axis. Not all the sequential biochemical events of seed-germination and embryo growth are precisely identified yet. There are various reports on the role of gibberellins, kinins and auxins during germination (Chinoy, 1962; Thimann, 1963;
Leopold, 1964; Amen, 1968; Black, 1970) but as their universal presence in the physiological systems is yet to be established, the mechanism of action is yet not clear, and the response with seeds of diverse food reserves is not convincing, it cannot rightly point to the fact underlying the process of seed-germination. Moreover one should be very careful while giving priority to only a single factor in biological systems as they are mediated by the interaction of various factors, where no one is independent of other. So, there must be some metabolites which besides their interaction, co-ordinate with various enzymic systems working within the cell and participate actively in all biochemical events starting from imbibition of water by the seed up to the full grown seedling.

Work done in this laboratory has yielded very conclusive evidence on the role of universally occurring growth-regulator ascorbic acid; not only during germination but also during growth and development. Being present in each and every organelle of the cell it participates in almost all the processes of growth and development (Chinoy, 1962, 1967, 1968, 1969; Chinoy et al., 1969, 1970, 1971). There are reports also about the function of nucleic acids during germination (Cherry, 1963; Ingle et al., 1964) as well as growth and development (Sen, 1964; Cutter, 1965;
Chinoy and Mansuri, 1966). One can try to understand the mechanism of action, or the influence of this growth regulator on seedling growth by its exogenous application. Such reports are, however, very few. Therefore, the synthesis and utilisation of these metabolites and reserves in co-ordination with the activities of related enzymes at certain time interval, will possibly explain all the sequential events during seed-germination.

After germination, growth and developmental processes continue resulting into an adult plant which culminates its life processes by setting seed for the next generation. The typical green flowering plant is thus a master organic chemist, synthesising a complex of simple and elaborate compounds for its daily metabolism, its structural frame-work and its vegetative and reproductive development. The growth and developmental pattern of the plant is very profoundly influenced by the external factors like light, temperature etc. Duration of light has so great an influence on the metabolism that a slight shift in its duration can alter the whole morphophysiology of the plant. Profound metabolic changes are associated with the onset of reproductive phase as a consequence of the photoperiodic treatment (Sen, 1964). Chinoy (1967) points out that "considering the fact that a profound change in the
norm of differentiation accompanies flowering, it would be more fruitful to study the various aspects of metabolism underlying the phenomenon." Number of workers have studied the effect of factors like nutrition, daylength, light-intensity, temperature, growth-period and others on the growth and differentiation of vegetative and reproductive parts (Chinoy, 1962; Hillman, 1962; Salisbury, 1963; Cutter, 1965; Mansuri, 1965; Patel, 1967).

At the onset of reproductive differentiation, not only the reproductive organs but the whole plant is in active metabolic state. The shoot apex is also a remarkable self-determining and autonomous organizing center of the plant and so a study of various metabolic events within this organ is likely to explain its role at various stages during growth and development. Starting from the flower producing substances of Sachs (1865), florigen theory of Chailakbyan (1936) and important roles attributed to various other growth regulators like auxins, gibberelins, there is not a single theory which can satisfactorily explain the mechanism of flowering. Moreover the balance between promoters and inhibitors will not also justify the solution of problem as there is no universality of growth regulators. Some of them are still unidentified substances, and the inhibitors are also not identified thoroughly in every plant.
So the only possible solution will be to estimate the level of naturally and universally occurring metabolites at the time of flower initiation as well as during the process of reproductive differentiation coupled with a study of activities of enzymic systems related to it. The correlation of photosensitivity of plants is worked out generally with growth and development but there are very few attempts to correlate it with metabolic status of the plant which will give the real answer to the problem. There are various reports of carry over effect of the inductive photoperiod on growth and developmental pattern after transferring the plants under non-inductive condition; but here again there are very few studies to correlate it with metabolism of the plant.

Considering the importance of nucleic acids, structural proteins and enzymes for growth and differentiation; the exogenous application of nucleic acids will help in understanding their role during these processes. Moreover taking into account the importance of ascorbic acid in creating a redox atmosphere via the formation of its free radical for the biosynthesis of the macromolecules and other cell constituents; it will be interesting to create such an atmosphere by introducing some substance in the cell system which accelerates the formation of free radical of ascorbic acid e.g. \( \text{H}_2\text{O}_2 \). There are reports on the inductive
effect of \( \text{H}_2\text{O}_2 \) on germination (Ching, 1959) but the whole mechanism is not fully understood.

As *Sesamum* is a SD plant, it does not flower under continuous illumination and the photoinductive effect increases with increasing number of inductive cycles. In order, therefore, to understand the metabolic events during germination as well as during growth and development under different photoperiods and to elucidate the role of the free-radicals of ascorbic acid in energy transfer mechanism for biosynthesis; the following work was undertaken in *Sesamum indicum* L. cv. Limbdi.

I Ascorbic acid turnover, synthesis of nucleic acids and proteins in relation to enzymes like, general peroxidase, AA-FR-peroxidase, protease, RNase, catalase and lipase during the early stages of germination.

II Effect of different photoperiods on growth, flowering and metabolic as well as enzymic activities involved in the synthesis of ascorbic acid, nucleic acids and proteins.

III Influence of varying number of photoinductive cycles on growth and developmental pattern as well as on ascorbic acid and nucleic acid metabolism.
IV Effect of exogenous application of ascorbic acid, RNA and DNA with and without $H_2O_2$ on seedling-growth and metabolic changes associated with juvenile differentiation.