SUMMARY

Although extensive literature has accumulated on the morphological and anatomical changes taking place during reproductive differentiation as well as with regard to the embryological changes during anther, ovule, embryo and endosperm development, little is known about the histochemical changes governing the process of growth, development and differentiation in these organs. Hence the object of the present study is to elucidate any possible relation between drifts in the levels of cell constituents and the development of the vegetative and reproductive organs.

A pure line variety of Zea mays L. was used for the histochemical study. The shoot apices from vegetative to reproductive stages, young florets, anther and carpel before and after fertilization were fixed in respective fixatives for histochemical studies for ascorbic acid (Ghinoy, N.J., 1969; Dave et al., 1968), DNA by Feulgen reaction (de Tomasi, 1936), nucleic acids by methyl green pyronin method (Taft, 1951), basic proteins by fast green test (Alfert and Geschwind, 1953) and -SH groups by DDD method of Barnett and Seligman (1952).
For the quantitative determination of the cell constituents, the staining intensities have been measured with the help of the cyto-photo-electrometer designed in our laboratory. The cross sectional area of the cell ($\mu^2$), the nuclear volume ($\mu^3$), the nucleolar volume ($\mu^3$) and the ratios of the nuclear size/cell size and nucleolar/nuclear volume were determined with the filar micrometer. The extinction value was then either multiplied by the cell area to obtain the total content per cell or the values were divided by the cell area to obtain the concentration of the metabolites per unit area of the cell.

Using the values of the various constituents per unit area of the cell, linear regression of DNA, RNA, basic protein and -SH groups on ascorbic acid were determined and the regression trend lines were plotted. The trend line in each case was determined on the basis of the regression equation. Adequate controls were run at all times for every determination.

Staining reactions for different metabolites are summarised below:
1. All metabolites including ascorbic acid, DNA, RNA, basic protein and -SH groups increase at the differentiation of the shoot apex.

2. The transforming apex, branch primordia, spikelet primordia and floret meristem showed an upsurge in the content of AA, DNA, RNA, basic protein and -SH groups in the cells of the shoot apex.

3. Cytoplasmic basic proteins, DNA and RNA are remarkably high in the shoot apex during floral induction and differentiation.

4. The concentration of AA, DNA, RNA, basic protein and -SH, the total content per cell and the content per unit area of the cell show a parallel trend in the shoot apex.

5. During anther development and microsporogenesis, an increase in concentration of AA, DNA, RNA, basic proteins and -SH groups are noted in the sporogenous tissue and in the mature pollen grain.

6. Cytoplasmic DNA and basic protein concentrations were high in the sporogenous tissue and in the meiocytes during anther development.
7. Concomitant with the increase in cell metabolites, the tapetum showed a reduction during the formation of pollen mother cell.

8. The primordia of carpel and ovule showed very high content of AA, DNA, RNA, basic proteins and -SH group. The mucellar cells in the centre show a deep staining reaction.

9. The megaspore mother cell contains high AA, DNA, RNA, basic protein and -SH in the nucleus, but its cytoplasm contains a very feeble staining reaction with all the contents.

10. During the formation of the embryo sac the cytoplasm contains high AA, RNA, basic protein and -SH but the total content declines as the individual cells of the embryo sac differentiate.

11. The antipodals and synergids show high level metabolites indicating their active role.

12. The zygote and primary endosperm nucleus show a high content of AA, nucleic acid, basic proteins and -SH as two new growth centres are initiated by them.
13. The zygote divides to form the apical cell ca and the basal cell cb. All the metabolites clearly establish the polarity.

14. During embryogenesis, the content of AA, DNA, RNA, basic protein and -SH increased in the embryo but per cell it showed a decline trend.

15. The most striking point is the presence of the highest concentration of all the cell constituents in the m tier cells and the cells of the l' as these are the regions from which the radicle and the plumule develop respectively and even it remains high on the germinal face, but as soon as the embryo axis is organised, there is a shift towards the scutellum with the result that the axis contains very low amount.

16. An increase of AA, DNA, RNA, basic protein and -SH in the free nuclear endosperm points to its active role during embryogenesis.

17. The linear regressions of DNA, RNA, basic proteins and -SH on ascorbic acid during shoot apex,
microsporogenesis, megasporogenesis, embryogenesis and endosperm development signify that the ascorbic acid is an important factor in growth and development and these metabolites form a closely interlocked gear.

18. Further, the data represented in this thesis, clearly support the ascorbic acid - nucleic acid - protein metabolism concept of growth and development in plants (Chinoy, 1962). The prime mover in the process of switching on the genetic machinery for growth, differentiation and development is the primary product of the cytoplasm - ascorbic acid (Chinoy, 1971).