I N T R O D U C T I O N

Cellular differentiation controls the time of emergence, the shape, the number, and the function of cells, their organization of tissues and specialized organs. In the molecular domain, differentiation of cells is fundamentally a switching of biosynthetic activity leading to the appearance of new macromolecular species whose accumulation and export are manifested as specialized structure or activity.

On the other hand, in the submicroscopic domain, cytodifferentiation would necessarily be reflected in occurrence and abundance, formation and modification, association and localization of various cell organelles. A comprehensive study on the ultrastructure of cellular differentiation in meristematic cells of maize root was carried out by Whaley and co-workers (1960, 1959a, 1959b) and Leech and co-workers (1963). They have been able to correlate certain cellular function and differentiation with various cytoplasmic organelles. Bal and De (1961) studied the developmental changes in the submicroscopic morphology of the cytoplasmic components during microsporogenesis in Tradescantia. They concluded that the development, maturation and breakdown of cytoplasmic organelles at various stages reflect a metabolic pattern of cell during microsporogenesis. From the study of

microsporogenesis and embryogenesis, Jensen (1965, 1963) could correlate ultrastructural changes with cell development.

To this end a study of the submicroscopic morphology of protoplasm of root apex cells would be of immense value, since the root apex contains diverse kinds of differentiating cells in a small tissue and its active growth is obviously associated with high rate of utilization of energy. The activity of the root cap is especially noteworthy because it casts off about one cell layer in every 12-24 hours, which is replaced by a new cell layer from inside. Moreover, detail information on its growth pattern is available from light microscopic studies (Esau, 1965 and Clowes, 1961). The root apex is also an easy material for electron microscopy. With this in view, the ultrastructure of root cap cells, epidermal and cortical cells of root apex of alfalfa was studied. The most remarkable observation is that as the root cap cells move from the innermost region to the outermost cell layer, hand in hand with various cellular changes, the lipid bodies are utilized with concomitant formation of vacuole.

The best manifestation of cellular differentiation is expected in the development of xylem element from procambial cells and secondary thickening of the tracheid wall. The present study on these cells indicates that the localized microtubules along the cell wall are instrumental in trapping Golgi-derived vesicles and for their localized deposition. Similar study was also carried on the development of secondary xylem elements.

In order to make a comprehensive study of the mechanism of cell wall deposition, the ultrastructure of microsporocyte and microspore was also studied. Microspores are unique in that they are differentiated within the essentially closed system afforded by the microsporocytes. It has been revealed in the present study that in addition to normal contribution of cytoplasm of microspores to the growth of the pollen wall, it may possibly grow by intussesception.