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Minireviews on Ascorbate in Membranes. Introduction

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The objective of these minireviews is to emphasize new membrane-associated functions of ascorbate in cell growth control and development. The effects stand in addition to the recognized roles as an antioxidant and as a cofactor for cell surface components.

The role of ascorbate as an oxygen scavenger in the aqueous phase of cells and as a cofactor in structural protein formation is well recognized. Here we consider how ascorbate enters into the microenergetics of membranes. The review by Beyer considers the protective antioxidant action of ascorbate in membranes by interaction with the more traditional lipophilic antioxidants associated with membranes. Movement of ascorbate into and within the cell and the transporter systems required for the movement is considered by Goldenberg. Maintenance or stabilization of ascorbate levels in cells through the actions of membrane-bound enzymes such as semidehydroascorbate reductase or the glutathione-dependent protein disulfide isomerase or glutaredoxins for dehydroascorbate reduction are considered in the reviews by Wells and Rodriguez-Aguilera and Navas.

The role of membranes in the oxidation–reduction reactions of ascorbate is further examined in Rubinstein's review of studies with natural and artificial vesicles. These studies clearly show the presence of transmembrane oxidoreductases which can use ascorbate as a substrate in addition to soluble or surface-associated enzymes.

The dynamic effects of ascorbate and semidehydroascorbate on animal cell growth and development is then considered by Alcain and Buron. The action of ascorbate is related to membrane-based redox control functions as well as the long recognized role in extracellular structure and cell differentiation. Cordoba and Gonzales-Reyes then focus on ascorbate movement and function in plant cells where a role in extracellular structure begins to approach the function in animals. They then consider direct redox effects in plant growth through reactions at the plasma membrane. The use of lycorine to decrease ascorbate levels in plants and the relation of ascorbate changes to growth and developmental change in plant cells is then considered by Arrigoni. Finally, the oxidation–reduction reactions at the plasma membrane, including those depending on ascorbate, are discussed in relation to growth control by Morré. It is apparent that study of the regulatory functions of ascorbate at cell membranes is entering a new phase. These effects stand over and above the well-known antioxidant and structural catalyst roles.

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