8 Biosynthesis and Metabolism of Vitamin C in Suspension Cultures of *Scutellaria baicalensis*

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Vitamin C (L-ascorbic acid, AsA) has been of great interest because it plays a significant role in cellular defense against oxidative stress and in nutritional value as a soluble antioxidant. However, the biosynthetic pathway of AsA has remained unknown in plants, even though it is abundant at mM concentrations in most plant tissues. To get the basic information for the metabolic engineering study of AsA in plants, the concentrations of AsA and its biosynthetic and metabolic-related enzymes such as L-galactono-1,4-lactone dehydrogenase (GLDase), ascorbate peroxidase (APX) and ascorbate oxidase (ASO) were investigated in suspension cultures of *Scutellaria baicalensis*. The AsA content slowly increased to 19 days after subculture (DAS), and reached a maximum at 21 DAS (ca 120 $\mu g\ g^{-1}$ dry cell wt), and then rapidly decreased with further cultures. GLDase and ASO activity showed a well correlation with the cell growth curve showing a maximum on 19 DAS, whereas APX activity showed a well correlation with the changes in AsA content showing a maximum on 21 DAS. The total ascorbate contents (reduced form, AsA and oxidized form, dehydroascorbate, DHA) were markedly enhanced by 5.5 and 6.8 times on 10 DAS, respectively when L-galactose and L-galactono lactone (25 mM) were added to SH medium supplemented with sucrose 20 $g\ l^{-1}$ on 9 DAS. Interestingly, DHA occupied more than 90% of total AsA contents in suspension cultures of *S. baicalensis*, even though the ratio of reduced and oxidized forms was slightly different by the cell growth stage and kinds of possible precursors used. The future plans for increasing of nutritional value and stress tolerance in plants will be discussed in terms of the metabolic engineering of AsA.

Keywords: ascorbate (vitamin C), biosynthesis, metabolic engineering, suspension culture