ABSTRACT

"PEP Carboxykinase in Plants: An Enzyme for all Seasons"

Prof Richard C. Leegood
Robert Hill Institute
and Department of Animal and Plant Sciences
University of Sheffield
UK

Phosphoenolpyruvate carboxykinase (PEPCK) catalyses the reversible nucleotide triphosphate (GTP- or ATP-) -dependent decarboxylation of oxaloacetate to PEP and CO_2. The ATP-dependent enzyme is present in flowering plants, fungi, algae and many bacteria, the related GTP-dependent enzyme in animal tissues. PEPCK is present in many plant tissues and appears to be located exclusively in the cytosol, although it may be plastidic in diatoms. It is regulated in some, but not all, plant tissues by reversible protein phosphorylation. Some of its functions in plants are well understood, such as its role in the photosynthetic CO_2-concentrating mechanisms of C_4 photosynthesis (including diatoms) and in Crassulacean Acid Metabolism. In these, PEPCK provides CO_2 for the Calvin cycle by decarboxylating OAA derived from C4 acids. Its role in gluconeogenesis following germination of fat-storing seeds is also well studied. However, in recent years it has become clear that PEPCK is present in only certain types of cells and that its abundance is often dependent on developmental stage. It thus functions in far more metabolic processes in plants than was previously realised, but, as in many animal tissues, its function has been less easy to discern. Within leaves, although not abundant overall, it may be present in phloem companion cells, hydathodes, trichomes and stomata. In stomata, data from Arabidopsis knock-outs suggest that it plays an important role in stomatal closure. It has been identified in a range of tissues, such as developing seeds, flowers, roots, vascular tissue and fruit. In developing pea or grape seeds laying down storage proteins it is implicated in the metabolism of incoming nitrogenous compounds. This seminar will outline the regulation of the activity of PEPCK in plants and discuss some of its physiological functions.