

## EXPANSINS AND THEIR ROLES IN REGULATING PLANT GROWTH

Yajun Wu<sup>1</sup> and Elizabeth Davis<sup>1</sup>

### ABSTRACT

Expansins are a group of proteins that were initially isolated from cell walls of cucumber hypocotyls and were capable of inducing cell wall extension *in vitro* (1). Based on the sequence similarity, expansins are found in almost all the land plants studied, including moss and fern, and comprise multigene families (2). Some expansins preferentially induce extension of type I cell walls, while some can only cause extension of type II cell walls. These observations indicated that different expansins may act on different substrates in cell walls (3). Our knowledge on how expansins induce cell wall extension is still very limited. Expansins have no significant hydrolase activity and are able to weaken pure cellulose paper (4). It has thus been proposed that expansin proteins loosen cell walls in an unconventional way by weakening glucan-glucan interactions between wall polymers. Since cell wall loosening is one of the key factors that determine the rate of cell elongation and expansion, expansins are believed to be important for regulating plant growth. Expression of expansin genes in many plant species is indeed closely associated with the cell elongation/expansion process. Over-expression of certain expansin genes in *Arabidopsis* and rice increased plant sizes, while suppression of their gene expression reduced their size (5, 6). These studies provide direct evidence that expansins are capable of controlling cell expansion and thus plant size. Increasing evidence has indicated that expansins are involved in other processes in plants presumably also through softening the cell walls. These functions include seed germination, pollination, fruit ripening and response to environmental stresses. A large collection of expansin studies in the literature addresses expansin gene expression during fruit development and ripening. It has been shown that different fruit development stages involve different expansin genes with certain overlap for some of the expansin genes. Suppression of a tomato expansin gene whose expression was mainly associated with fruit ripening process improved fruit firmness with no side-effect on fruit size (7). Thus, there is a great potential application of using expansin proteins for controlling certain aspects of plant growth and development, such as increasing plant production and controlling fruit quality.

### LITERATURE CITED

- McQueen-Mason S, DM Durachko and DJ Cosgrove. 1992. *Plant Cell* 4: 1425-1433.  
Cosgrove DJ et al. 2002. *Plant Cell Physiol.* 43:1436-1444.  
Cosgrove DJ. 2000. *Nature* 407:321-326.  
McQueen-Mason S and DJ Cosgrove. 1994. *Proc Natl Acad Sci USA* 91:6574-6578.  
Cho HT and DJ Cosgrove. 2000. *Proc Natl Acad Sci USA* 97:9783-9788.  
Choi et al. 2003. *Plant Cell* 15:1386-1398.  
Brummell et al. 1999. *Plant Cell* 11:2203-2216.

---

<sup>1</sup> Department of Plants, Soils and Biometeorology, Utah State University, Logan, UT 84322, USA