Genetic Resources

Genes Encoding Cell Wall Proteins

Allan Showalter, Marcia Kieliszewski, Alice Cheung, and Mary Tierney

showalter@ouvaxa.cats.ohiou.edu
(AS) Department of Environmental and Plant Biology, Molecular and Cellular Biology Program, Ohio University, Athens, OH 45701, USA;
(MK) Department of Chemistry, Ohio University, Athens, OH 45701, USA;
(AC) Department of Biology, Yale University, New Haven, CT 06511, USA;
(MT) Department of Botany, University of Vermont, Burlington, VT 05405, USA

At least five classes of plant cell wall proteins are widely recognized: extensins, glycine-rich proteins, proline-rich proteins, arabinogalactan proteins, and solanaceous lectins (Showalter, 1993; Kieliszewski and Lamport, 1994). Based upon their abundance, their biased amino acid compositions, and their repetitive amino acid sequence units, these classes apparently represent structural proteins. In addition to this structural role, these proteins are likely to have other functions intimately associated with their structural role. For example, certain extensins and glycine-rich proteins are up-regulated in response to pathogen infection, while several of the proline-rich proteins are early plant nodulins (Showalter, 1993). At present, cDNA and genomic clones are recorded for only three of these five classes of wall proteins. Consequently, we generally thought it would be most useful for the present time to group the cell wall proteins that have been cloned into one of three classes:

Gene Product	Mnemonic
Extensin	*Ext0*
Glycine-rich protein	*Grp0*
Proline-rich protein	*Prp0*

In discussions within the working group and with other cell wall protein colleagues, there is some concern that we are attempting to put these molecules into nice, neat little packages when in fact nature does not always work in such a black-and-white manner. Clearly, we see much variation (i.e., shades of gray) in the cloned sequences that we have tentatively classified into three groups. Such variation is particularly characteristic of structural/morphological sequences where the repetitive nature of these sequences and the expression of multiple members of these moderately sized gene families apparently allow for considerable evolutionary experimentation. The *0* designation in each of these classes represents a grouping of all recorded entries for genes encoding extensin, glycine-rich protein, and proline-rich protein. In the future, certain members of these cell wall protein classes may eventually be distinguished as members of specific subclasses (e.g., *Ext1*, *Ext2*, *Ext3*, etc.), but until such subgroupings become more clear the nomenclature system outlined above seems preferable.

As a final note, we foresee a problem in classifying cloned sequences (when they become available) for some of the known cell wall proteins that are clearly composite proteins, consisting, for example, of extensin sequences and arabinogalactan-protein sequences, or of extensin sequences and chitin-binding protein sequences.

CPGN-approved designations of genes, including those encoding cell wall proteins, are listed in *Mendel* at http://probe.nalusda.gov:8300/cgi-bin/browse/mendel.

Note added in proof: Since the preparation of this article, clones encoding arabinogalactan proteins have been isolated and sequenced (cf. Mau et al., 1995). These sequences appear in EMBL/GenBank (accession numbers U13066, U14009, S79358, and S79359). CPGN designations for genes encoding arabinogalactan proteins will be announced shortly.

References

Kieliszewski, M. J. and Lamport, D. T. A. 1994. Extensin: Repetitive motifs, functional sites, post-translational codes, and phylogeny. Plant J. 5:157-172.

Mau, S.-L., C._G. Chen, Z.-Y. Pu, R.L. Moritz, B.J. Simpson, A. Bacic, A.E. Clarke. 1995. Molecular cloning of cDNAs encoding the protein backbones of arabinogalactan-proteins from the filtrate of suspension-cultured cells of *Pyrus communis* and *Nicotiana alata*. Plant J. 8:269-281.

Showalter, A. M. 1993. Structure and function of plant cell wall proteins. Plant Cell 5:9-23.