Book Reviews

**Advances in pectin and pectinase research.**

Two indiscutable features distinguish plants from animals – one is the chloroplast, the other the cell wall. This volume is directed to the newest information we have on the cell wall, the major polysaccharide component, pectin, and the ways that pectins can be changed.

A summary of 36 papers presented at the Second International Symposium on Pectins and Pectinases (2001), this book describes aspects of synthesis, chemical constitution, properties and immunological identification of pectins with the molecular genetics, structure and function of the pectinases that modify or degrade the pectins. It provides the reader with comprehensive state-of-the-art views of what is without doubt one of the fastest developing fields in plant developmental regulation; one that embraces the cohesion and dissociation of plant cells and the dynamics of the ever-changing molecular organization of the wall itself.

We learn the molecular requirements for successful pollen adherence and growth upon the stigma and within the style, with the interaction of both specific protein and polysaccharide components for eventual fertilization. Several papers describe pectin ‘hairy regions’, the highly branched rhamnogalacturans that carry galactan and arabinan side chains. Their *in vitro* degradation by fungal pectinases or chemical treatment has led to new findings on the likely covalent linkages and wall pore sizes that exist *in vivo*. The partial purification of a membrane-bound enzyme that catalyses transfer of galacturonic acid to the wall pectin polymer has been achieved successfully in mung bean hypocotyls and a role for borate availability is clearly demonstrated for the cross-linking of primary cell wall pectin, rhamnogalacturan II. The biological effects of modifying these wall polymers by transformation, mutagenesis, or by the altered expression of pectinases are very clearly reviewed.

The level and positions of methyl esterification add another dimension to the complexity and properties of pectins. Not only is texture of fruits and vegetables so determined, so also is water holding capacity of the walls and the enzymic fragmentation patterns that can occur *in vivo* and *in vitro*. As with many other studies in plant biology, we really need to know precise details for specific cell types to see pectin relationships in proper context, but we are still a way from achieving this goal.

Such is the case in the comparisons of lime and orange pectin polymers extracted from fruit albedo. The hemicellulosic comparisons of unripe and ripe fruit and the mechanical properties of young and mature pea cotyledons tell a complicated story. Here, pectin side chain changes taking place during organ maturation require further study. Already, however, much has been achieved by the use of monoclonal antibodies in elucidating the deposition of the many oligosaccharide domains within cell walls, and this work too is very comprehensively reviewed. Other analyses show us that the pectic components from parenchyma cell walls from one species differ significantly from that of others. The pectins of any cell are therefore highly individual and diagnostic of both the physiological and the genetic state.

In the molecular genetics and biosynthesis of the different pectin degrading enzymes of plant pathogens we have useful chapters devoted to their action. *Aspergillus niger* has an arsenal of over 21 genes encoding different pectinases. We have a summary of the difficulties and successes in using galacturonic acid oligomers for the *in vitro* synthesis of pectic fragments. We have kinetics for the absolute requirement for Ca$^{2+}$ for lyases *in vivo* and a pinpointing of the arginine subsite for active endopolygalacturonase. The anti-sensing of pectin methyl-esterase in flax and records of the expression in the different parts of transgenic plants, including callus cultures, is an intriguing picture of developmental and tissue-specific responses.

Pectins are a problem for all protein and secondary product extractions, so the upregulation of a xylogalacturonan-degrading enzyme is a valuable approach to solving incomplete pectin removal. Chapters on polygalacturonases, pectin methylesterases and their protein inhibitors, the conserved sequence similarities of rhamnogalacturonan acetyl-estersases and the single and synergistic action of bacterial and fungal esterases upon pectins in plant extracts provide a critical overview of the extreme complexities inherent in the saccharide components of the protective plant cell wall and the many endogenous or pathogenic enzymes to which it is constantly subjected.

Not only are these studies important for understanding the molecular control of survival of the growing plant, they are equally applicable to best storage of plant material...
and the commercial derivatization of pectins into other products from harvested plant parts. Chapters showing how molecular composition of pectins can determine the texture and acceptability of a final product bring home the tremendous importance of the investment that any plant makes in the distribution of fixed carbon to its cell wall pectins.

This volume is a gem. Contributors and editors should be congratulated on the careful and uniform presentation, the excellent texts and their wealth of up-to-date information and references. My only disappointment is the lack of an index – a great pity!

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Sulfur transport and assimilation in plants: regulation, interaction and signaling.

Sulphur metabolism of plants (I’ll stick with British English spelling here) has always received less attention and attracted less funding than has research on nitrogen and phosphorus. One of the most important reasons no doubt is that, unlike nitrogen and phosphorus, sulphur availability to plants was rarely a problem. As the post-World War II use of fertilizer in agricultural areas increased, so did inputs of sulphur derived from fossil fuels. Excess sulphur in the form of sulphur dioxide was of course recognized as one of the factors involved in acid rain, and research into sulphur from that point of view was particularly popular until the measures to reduce sulphur inputs into the atmosphere from fossil fuels started having effect. But then decreased atmospheric inputs of sulphur led to cases of sulphur deficiency in certain areas in relatively recent times, which gave rise to new initiatives in research of sulphur nutrition and metabolism in plants. Still, the sulphur research community is much smaller than that of nitrogen or phosphorus. Lack of awareness and understanding in the wider community of the importance of sulphur to plants, and of its intricate relationship with nitrogen and carbon metabolism have perhaps impeded availability of funding for this area of research. But this has not deterred the community of researchers working on sulphur in plants, which has grown into what Christian Brunold in his foreword calls the ‘sulfur family’, and which has been very effective in expanding knowledge and raising public awareness of sulphur metabolism in plants.

This book is a compilation of papers presented at the 5th International Workshop on Sulfur Nutrition and Assimilation in Higher Plants, which was held in Montpellier, France, in April 2002. The first section contains 13 invited papers, the second about 65 contributed papers. As the title of the workshop suggests, most papers address the many facets of sulphur nutrition and assimilation in plants and related molecular and genetic aspects, but other topics, such as the functions of sulphur in physiology of metals, its role in determining taste in wines, and even its importance to the quality of sheep’s wool, are also addressed.

The sulphur research community has been very active over the past decade in producing texts on all aspects of sulphur nutrition and metabolism in plants. This book is complementary to the existing publications, partly because it takes a more holistic view. Unlike the previous books that have come to my attention, several of the invited papers in this book address the relationship between processes at the molecular scale and whole-plant integration and regulation. For example, Hawkesford and co-workers focus on the functions of sulphate transporters and integration with whole-plant nutrition, while Touraine and co-authors compare regulation of sulphate uptake with that of nitrate. Other contributions, for example Brunold and co-authors and Roje and Hanson, address the relationship between S, N and C metabolism. There are also several contributions on the sulphur-analog selenium, and on non-crop plant species, such as the common reed (Phragmites australis), algae and mosses.

This book is well presented with generally good quality reproduction of tables and figures. Both author and subject indices are provided. It gives an excellent overview of the research currently being carried out on sulphur metabolism in plants. But that does not restrict its relevance to researchers in this specific subject area. Due to the intricate relationship of sulphur metabolism with nitrogen, carbon and phosphorus metabolism, anybody interested in nutrition of plants should find this book useful.

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