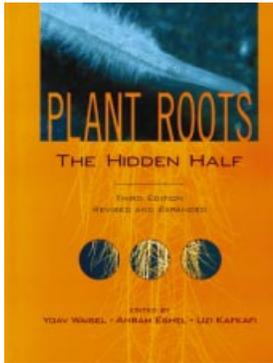


Book Reviews

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**Plant roots – the hidden half.
3rd edn.**

Waisel Y, Eshel A, Kafkafi U,
eds. 2002.

New York, Basel: Marcel
Dekker Inc.

\$250.00 (hardback). 1136 pp.

Research on plant roots represents an exciting and intriguing field of science. Undoubtedly, the vast majority of researchers within the

field are familiar with the first (1991) and second (1996) editions of this book. Since these editions were published, understanding of root biology has been advanced by using molecular biology methods and molecular genetic tools which offer novel perspectives for the exploitation and understanding of root structure and root processes. The third edition of *Plant roots – the hidden half* includes revised and expanded information on topics covered in the previous editions, as well as in additional fields, especially root genetics, molecular biology and biomechanics. It therefore constitutes a major reference book for practically all aspects of morphogenesis, physiology, ecophysiology and ecology of roots and root systems, and is very useful for those involved in root research. It contains 59 chapters written by 99 specialists in their subjects; chapters are grouped into ten themed sections.

Two chapters within the first section, 'The origin and characteristics of roots' describe phylogenetical aspects of root origin, and variation in morphology and architecture of root systems in relation to their primary functions, i.e. acquisition of soil-based resources and anchorage. The section entitled 'The root system: structure and development' (11 chapters) covers a wide range of topics: structural patterns and organization of the root meristem, root cap and lateral roots; root growth explored using kinematic analysis; root systems of arboreal plants and their biomechanics; root–shoot relationships; and turnover of roots. The role of hormones and regulatory molecules in the tip-growing root hairs has replaced the previous description of their structure and biology. A new chapter on secondary growth of roots at the histochemical and cell biology levels is of particular value. In 'Root genetics' (four chapters), wheat and banana roots are used as models to describe the heritability and genetic diversity of their traits. The chapters provide current insights into the genetic network operating in the formation and function of roots, and discuss the possibility of their exploitation in root bioengineering. The theme 'Research techniques for root studies' (four chapters) provides a survey of different techniques and methods currently used in

laboratory and field root research. An overview of microsensors techniques and a specific section on rooting in micropropagules of trees have been included in this new edition. The last chapter deals with modelling the development and architecture of root systems. In the section entitled 'The regulation of root growth', analyses of the role of growth regulators in root biology are presented, with emphasis on the roles played by chemical signals moving between roots and shoots, generation of root signals and current knowledge of what constitutes a signal. Of particular value is the chapter dealing with the environmental sensing and directional growth of roots. Within the theme 'Physiological aspects of root systems', the important root functions are characterized: respiration; regulation of root pH; processes involved in uptake and transport of nutrients in the roots and at the soil–root interface; and root-induced changes in nutrient mobilization and availability, in association with mycorrhizal and non-infecting rhizosphere microorganisms. Another two contributions focus on the impact of root system characteristics on water uptake from soils with differing water supplies, and on ecological aspects of water permeability of roots. The last chapter describes physiological interactions between plant roots and inorganic carbon in the soil–root zone and tackles the question of how shoot physiology and plant growth respond to the uptake of this carbon by roots. As in the previous editions, the theme 'Root growth under stress' (six chapters) includes the effects of abiotic stresses (temperature, oxygen deficiency, trace elements, salinity). Aluminium toxicity is discussed in a separate chapter focusing on fundamental problems such as signal perception and transmission, and regulatory mechanisms of the synthesis and exclusion of organic acids. A review of the effects of mechanical stress on root morphogenesis and root–shoot signalling provides readers with a more systemic approach to this problem. Evidence for mechanisms of sensing soil mechanical forces by roots, and a direct signalling of these forces locally as well as throughout the aerial parts of the plant is well presented. The theme 'Root–rhizosphere interactions' (six chapters) is devoted to the role of microorganisms (symbiotic N₂ fixation, mycorrhizae, rhizosphere bacteria, soil-borne pathogens), nematodes and fungal root endophytes. The literature cited shows that significant advances in our understanding of beneficial associations between rhizosphere bacteria and plants have been achieved using structural and functional genomic approaches. The last two sections are devoted to the roots of various ecological groups with special emphasis on desert plants, aquatic plants, contractile roots and roots of *Banksia* spp. with regard to functioning of their specialized proteoid root clusters, as well as on roots of economic value, e.g. on roots as a source of metabolites with medicinal activity or roots as a source of food.

The editorial work involved in a book of such great length must be extremely demanding and runs the risk of invoking criticism. One could comment on the arrangement of individual chapters within a theme, the repetition of some information in more than one chapter, and on the heterogeneous approaches of the authors of individual chapters (as mentioned by the editors in their Introduction; some chapters review recent data, some can serve as a textbook for students, whereas others detail specific aspects or are reminiscent of a scientific paper). Technically, the book is excellent, with only small mistakes (e.g. some missing references, the colour figures are not placed where one might expect). The book is an excellent source of recent information on the state-of-the-art in root research. Practically all of the chapters have been updated and more than one-third of them deal with new topics. We recommend this book to advanced students and teams of scientists working in many areas of root research, in plant physiology, soil science, plant breeding, forestry and horticulture.

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Milada Čiamporová**

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