

Preface

This book is blessed with 14 wonderful chapters aimed at summarizing in part the current knowledge on the structure and function of plant microtubules and actin filaments. Since the initial discovery of microtubules in plant cells in 1963 and the visualization of green algal actin filaments in 1974, their dynamic behaviors and their roles in specific cellular functions have been embraced one after another. While plant cell biologists continue to be excited by the beautiful cytoskeletal network in plant cells, their understanding of the function behind the network has been greatly advanced by discoveries of novel proteins that interact with the network. Recent progress has benefited from technological advances in areas like live cell imaging, genetic screening, and the tools of genomics and proteomics.

In this book, the first six chapters visit the molecular basis of the plant cytoskeleton. Since the first plant genome was sequenced, the number of genes encoding cytoskeletal proteins has stunned us. From isolating actin and tubulin genes to uncovering those encoding myosins and kinesins, plant biologists have made tremendous progress in the past decade or so. Nineteen years ago when microtubule-translocating activities were first demonstrated in isolated phragmoplasts, no one could have predicted that the little *Arabidopsis* plant would have more microtubule-based motor kinesins than are encoded in the human genome. In the post-genomic era, new avenues have opened and are leading to explosive discoveries made by mining sequenced genomes and characterizing the functions of proteins encoded by novel cytoskeletal genes. Undoubtedly, characterizing the proteins that interact with the plant cytoskeletal network becomes a task that is integral for our understanding of plant evolution.

The second part of the book includes three chapters that cover how microtubules are arrayed during plant cell division. It is both puzzling and fascinating that plant cells are able to organize microtubules into arrays like the preprophase band, the bipolar spindle, and the phragmoplast in the absence of a structurally defined organizing center. Fortunately, the molecular mechanisms underlying the organization of these arrays are emerging. Again, advances made in this area will provide many clues regarding how land plants have evolved.

The book ends with a section devoted to connecting the cytoskeleton with plant growth and development. These five chapters summarize current knowledge on the mechanisms that regulate different patterns of cell growth as well as on how the

growth of whole organs is regulated by the cytoskeleton. Plants demonstrate remarkable patterns of growth, and their tissues and organs are built on cells of splendid shapes. How plant cells acquire their distinct shapes is an intriguing question. After their birth in the meristem, plant cells respond to internal and external cues that direct the acquisition of specific roles after differentiation. Once these cues are read, the cytoskeletal network is remodeled and it guides changes to the cell wall that influence cell shape. These changes, ultimately, determine the shape of the plant and they reflect adaptations to environmental conditions that plants have made over millions of years.

This book is not intended to cover every aspect of the plant cytoskeleton. Besides serving as a convenient reference, it is intended to generate enthusiasm amongst young scientists to join the efforts to dig out the root of the plant cytoskeleton. The plant cytoskeleton is no longer a subject reserved for cell biologists. Its impacts on plant growth and development can no longer be overstated. I hope that the chapters included in this book inspire additional in-depth studies focused not only on the cytoskeleton, but also on its links with developmental phenomena and plant responses to the environment.

Much of what we have learned about the plant cytoskeleton has been inspired by the careful observations of many pioneers in the field of plant cell biology. I am particularly indebted to my mentor Prof. Barry A. Palevitz who has been an inspirational source for me and others through his discoveries and visions.

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<http://www.springer.com/978-1-4419-0986-2>

The Plant Cytoskeleton

Liu, B. (Ed.)

2011, XII, 331 p., Hardcover

ISBN: 978-1-4419-0986-2