

Preface

This volume brings together recent findings about mechanistic understanding in diverse areas of plant adaptation. It offers the readership novel insights into contemporary results concerning the evolution, development, and stress responses. Moreover, it uniquely combines the technological and methodological perspectives. This volume aims not only to review the published results but also to introduce new concepts, discuss novel findings, and offer original views on the perspectives and challenges in this field. Therefore, it provides balanced coverage of materials suitable for both experts and newcomers to this area.

This book is organized into nine chapters. The first chapter summarizes recent advances in high-throughput technologies that are necessary to delve deeper into the molecular mechanisms of plant adaptation. Further, the use of natural variation in *Arabidopsis thaliana* in the studies of local adaptation and evolution is reviewed. The third chapter provides a specific example of how natural variation can be used in combination with candidate gene approaches to understand the mechanisms of seed dormancy and viability. The next three chapters provide unique views on mechanistic understanding of plant responses to abiotic and biotic stresses. In Chapter 4, the abiotic stress response in plants is examined from a single-cell point of view. In Chapter 5, the metabolic responses to biotic stress in plants are introduced. In Chapter 6, the latest developments in the role of small RNAs in both biotic and abiotic stress responses are presented. The next chapter deals with the evolutionary perspective in understanding adaptation. It tackles the adaptation of flower form, with a special focus on an evo-devo approach, revealing the evolutionary history of the *SEPALLATA 3* gene. The challenge of employing the data from high-throughput technologies in understanding the mechanisms of plant adaptation may be addressed by mathematical modeling. To this end, the determination of adaptive patterns and the predictions on plant behavior are presented in Chapter 8. The final chapter highlights the importance of combining laboratory work with field experiments and is indented to help the reader formulate the guidelines on how field experiments should be performed and what factors should be taken into account. While each chapter can stand on its own, I hope that the readers will find the entire volume interesting and offering them comprehensive understanding of the current hot topics in plant adaptation.

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