Genetics and Genomics of Soybean

Plant Genetics and Genomics: Crops and Models

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Foreword by Bob Goldberg

Springer

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Foreword

Genetics and Genomics of Soybean, Edited by Professor Gary Stacey, is a remarkable collection of articles by internationally-recognized experts in the field of soybean genomics – many of whom helped to develop the tools and resources necessary to establish soybean as a powerful crop to investigate important basic and applied questions of plant biology. This collection of articles provides a comprehensive up-to-date review of the field of soybean genomics, and documents how far this field has advanced in the last few years. From the vantage point of someone like myself who first began investigating the organization and expression of the soybean genome thirty years ago, the insights provided by the authors in this book indicate that soybean has indeed "come of age," and that decades-old mysteries of the soybean genome are now being illuminated. *Genetics and Genomics of Soybean* is divided into four sections: (1) soybean genome natural history and diversity – which includes chapters on the genetic variation of the soybean genome and its relationship to other legume genomes; (2) tools, resources, and approaches – which includes reviews of technological advances that are being used to study the soybean genome – including the first glimpse of how the soybean genome is being sequenced and assembled; (3) investigations of soybean biology – which contains chapters that review how genomics tools have been used to study important questions – such as seed development, host-pathogen interactions, abiotic stress, and metabolic pathways; and (4) how Roundup Ready soybeans, generated by genetic engineering, have made an impact on global soybean agriculture. The chapters in this book are essential reading for students and investigators interested in basic and applied aspects of soybean biology. They provide a timely, comprehensive review of the field of soybean genomics, document the status of where the field is today, and, most importantly, raise many exciting questions about soybean evolution and biology that can now be answered using the genomics tools and resources outlined in this important book.

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Preface

Plant genomics is revolutionizing our understanding of basic plant biology and, yet, the impact on major crop plant species is still limited. Until recently, emphasis has been placed on 'model' plant species (e.g., Arabidopsis, and for legumes, *Lotus japonicus* or *Medicago truncatula*, see Chapters 3 and 4). However, if these are models, then what are they models of? Where will we apply the knowledge obtained from the 'models'? Clearly, the targets must be crop plants, which ultimately provide the benefit to mankind. However, why work with models and then test these discoveries in crop plants, when the resources are available to make the original discoveries in the crop? In this scenario, application is direct and immediate.

The Fabaceae (leguminosae) comprise the second largest family of flowering plants with 650 genera and 18000 species. The soybean is a member of the tribe Phaseoleae, the most economically important of the legume tribes (Chapter 2). The soybean, *Glycine max* (L.) Merr. is the major source of vegetable oil and protein on earth (see Chapter 1). As described in detail in this volume, knowledge of soybean genomics and genetics has advanced rapidly to the point that many of the resources previously only available for 'model' species are now ready for exploitation in this crop. Soybean has a very detailed genetic map (Chapter 5), a recently completed physical map (Chapter 6) and developing resources for reverse genetics to study gene function (Chapter 9). As this volume goes to press, it is anticipated that the full sequence of the soybean genome is nearing public release through the efforts of the US Department of Energy-Joint Genome Institute (see Chapter 7 for a preview). This represents a major milestone in ***Genetics and Genomics of Soybean*** and will enable practical applications for soybean improvement.

Knowledge of the soybean genome is already enhancing soybean breeding through the application of molecular assisted selection (Chapter 8). In addition, this information is being applied to both basic and applied research in priority areas. For example, the soybean seed is the major product of the plant and detailed studies, using a full repertoire of functional genomic methods, are well underway (Chapter 11). These studies include the analysis of biochemical pathways involved in both oil and protein synthesis (Chapter 12). The recent resurgence of interest in soybean as a biodiesel source makes these studies particular relevant. Soybean is also a 'heart health food', as designated by the US Food and Drug Association. This is in large part due to the production of a wide variety of bioactive secondary

products (Chapter 13). Genetics and genomic information also have an important role to play in improving soybean production. For example, efforts are well underway to apply this information to improve stress (both biotic and abiotic) resistance (Chapters 14, 15, 16, and 17).

The world's expanding population, coupled with growing concerns about the environment and climate change, present tremendous challenges for agriculture (Chapter 1). How will we feed the future expanded population of our planet, with decreasing land in the face of rising environmental challenges? Clearly, legumes, especially soybean, can make significant contributions due to the benefits of crop rotation and influences on soil fertility. It is also clear that biotechnology (for example, in the form of transgenic crop plants) will play an ever increasing role in agriculture. However, this remains a controversial area in many parts of the world. The experience of herbicide resistant soybeans, one of the first transgenic crops to be grown on a large scale, may provide insight into the benefits and future use of biotechnology in agriculture (Chapter 19).

This volume represents a compilation of timely topics pertinent to modern genetics and genomics of soybean. The chapters are written by recognized experts and provide an excellent primer for the no-doubt astounding developments that will come in the future from the full knowledge of the soybean genome sequence. I thank all of the authors for their wonderful and timely contributions. I also thank Jinnie Kim, Senior Editor, Springer Science and Business Media, for originally suggesting this idea and aiding in its development. Finally, special thanks to Jillian Slaight, Editorial Assistant, for moving the volume into production.

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