Preface

The beginning of the twenty-first century is certainly a great time for plant biology research. The beginning of the new millennium has placed an ever growing amount of sophisticated technologies at the disposal of the modern scientist to the benefit of all. The research performed with these technologies has the potential to provide the answers to important and complex biological questions and problems (especially those relating to crop plants and the human food supply) within reach.

Of those technologies, transcriptomics, proteomics, and metabolomics are increasingly being utilized for the near complete understanding of plant biology including seed development. These technologies are also loosely called the twenty-first century omics technologies, which have revolutionized the way research was being performed in the past in the field of seed developmental biology. Since the year 2000 these technologies have been largely optimized for model and nonmodel plants. As far as seed development is concerned, these technologies have already generated huge amount of data and continue to do so with astonishing pace. Those data have been organized and integrated in an efficient and confident manner using systems biology approaches. Generated data are being exploited for seed and yield improvement by combing these technologies with breeding and other classical molecular approaches. Indeed, when one looks at the progress achieved to date in the field of seed development and its overall impact on biological research, it is clear just how essential these technologies are to our understanding of the physiology and biology of any organism. It would not be far from the truth to say that the "power of technologies" (and indeed the omic sciences as a whole) is one of the driving forces of the twenty-first century seed biology research. The principles of good science are as true in this age of omics still hold true today and the disciplined scientist must keep these principles in mind to avoid rushing blindly into the field (intentionally or unintentionally) without first obtaining a thorough understanding of its fundamental principles.

When one looks at the impressive progress of above mentioned technologies in seed development as well as its immense importance in biological sciences as a whole, it is clear that there was a need for a textbook of the subject to translate/disseminate the knowledge acquired by leading experts in the field to the wider scientific community for some time. This was the impetus for the book you are

currently reading. Though we knew that such a project would be a formidable challenge, we also knew that it would bring us the opportunity to work closely with the leading experts of the field. What we did not fully appreciate when we started was how much of a truly unparalleled experience it would be to work with each and every one of the contributors of this book, whom we genuinely thank for being part of this ambitious endeavour.

This book is composed of seven sections including appendix in the following order: introduction to seed development and omics technologies/transcriptomics/proteomics/metabolomics/towards systems biology/and discovery-driven seed and yield improvement. There are 26 chapters which between them provide excellent coverage of almost all the studies conducted to date on seed development toward improvement of seed quality and crop yield. Each chapter also provides basic knowledge tightly associated with that particular topic. Seed physiology and developmental patterns have been discussed for most of the crops that are being widely utilized as research material; one might think of redundancy but we believe that those detailed descriptions are necessary for observed/recorded subtle differences, if any, associated with different seed species and to avoid any confusion especially for students. More than 1,000 references serve as a great resource for the academic and nonacademic communities. We hope this book will be beneficial in scope and practical knowledge to you the readers, whose response will be the final judge on the validity of the work. Moreover, the editing and organization of book have been done in a way that the book and its contents can also be used as text book for all level of students. This book is also dedicated to Dominique Job and Claudette Job in recognition of their contribution to the field of seed research and development (Foreword).

We also wish to thank our colleagues and collaborators around the world with whom we have struggled to do “good science”, forming new partnerships and friendships in the process. Though during our long journey in science many persons had an effect on us, but Masami Yonekura (Ibaraki University, Japan), Shigeru Tamogami (Akita Prefectural University, Japan), Akihiro Kubo (National Institute of Environmental Sciences, Japan), Nam-Soo Jwa (Sejong University, South Korea), Oksoo Han and Kyoungwon Cho (Chonnam National University, South Korea), Shoshi Kikuchi (National Institute of Agrobiological Sciences, Japan), Yu Sam Kim and Hyung Wook Nam (Yonsei University, South Korea), Kyu Young Kang and Sun Tae Kim (Gyeongsang National University and Pusan National University, South Korea), and Oliver A.H. Jones (University of Cambridge, UK) deserve both mention and appreciation. We would also like to acknowledge two young people, Abhijit Sarkar (Banaras Hindu University, India and Administrative Officer at International Plant Proteomics Organization—INPPO, www.inppo.com) and Raj Agrawal (Computer Programmer and Webpage Administrator at INPPO) for their constant support in our scientific achievements. We would especially like to thank Prof. Vishwanath Prasad Agrawal (RLABB, Kathmandu, Nepal) for his directions and guidance in our research (this is especially true for Ganesh who started his research under Prof. Vishwanath’s watchful eyes).

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To you the reader we also extend our thanks and appreciation. We hope this work will be useful to you.

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