Preface

Agrobacterium tumefaciens is a soil bacterium that for more than a century has been known as a pathogen causing the plant crown gall disease. Unlike many other pathogens, *Agrobacterium* is able to deliver DNA to plant cells and permanently alter the plant genome. The discovery of this unique feature has provided plant scientists with a powerful tool to genetically transform plants for both basic research purposes and for agricultural advancement.

The first transgenic plants were reported a little over 30 years ago in 1983 by three independent research groups. Using disarmed *Agrobacterium* vectors, these groups produced antibiotic-resistant transgenic tobacco *Nicotiana tobaccum* (Herrera-Estralla et al., 1983, Nature 303: 209), *Nicotiana plumbaginifolia* (Bevan et al., 1983, Nature 304: 184), and petunia (*Petunia hybrid*, Fraley et al., 1983, Proceedings of the National Academy of Sciences 80: 4803). The three scientists who led the landmark work, Marc Van Montagu, Mary-Dell Chilton, and Robert Fraley, were the laureates for the 2013 World Food Prize (http://www.worldfoodprize.org/en/laureates/2013_laureates/#StatementAchievement). As the statement of achievement of the World Food Prize says, "… each conducted groundbreaking molecular research on how a plant bacterium could be adapted as a tool to insert genes from another organism into plant cells, which could produce new genetic lines with highly favorable traits."

While other methods such as biolistic gun, electroporation, or polyethylene glycol can also be used for introducing DNA molecules into plant cells, the *Agrobacterium*-mediated transformation method remains the method of choices for most plant species in many laboratories due to its efficiency and its propensity to generate single or a low copy number of integrated transgenes with defined ends.

When the first edition of *Agrobacterium* Protocols was published in 1995, exactly 20 years ago, only a handful of plants could be routinely transformed using *Agrobacterium*. The second edition, which was published in 2006, collected transformation protocols for 59 plant species. In this third edition, we have updated protocols for 32 plant species from the second edition and added protocols for 17 new species. Together with the first and second editions, these two new volumes offer *Agrobacterium*-mediated genetic transformation protocols for a total of 76 plant species.

The third edition of *Agrobacterium* Protocols contains 57 chapters (two volumes) divided into 9 parts. This edition emphasizes on agricultural crops or plant species with economic values. For a number of important plants such as rice, barley, wheat, and citrus, multiple protocols using different starting plant materials for transformation are included. Like the second edition, plants are grouped according to their practical uses rather than their botanical classifications.

Agrobacterium Protocols provides a benchtop manual for tested protocols involving *Agrobacterium*-mediated transformation. All chapters are written in the same format as that used in the Methods in Molecular Biology series. Each chapter is contributed by authors who are leaders or veterans in their respective areas. The "Abstract" and "Introduction" sections provide outlines of protocols, the rationale for selection of particular target tissues, and information regarding overall transformation efficiency. The "Materials" section lists the host materials, *Agrobacterium* strains and vectors, stock solutions, media, and other supplies

necessary for carrying out these transformation experiments. The "Methods" section is the core of each chapter. It provides a step-by-step description of the entire transformation procedure from the preparation of starting materials to the harvest of transgenic plants. To ensure the reproducibility of each protocol, the "Notes" section lists possible pitfalls in the protocol and suggests alternative materials or methods for generating transgenic plants.

Typically, most laboratories only work on one or a few plant species. Each laboratory or individual researcher has his or her own favorite variation or modification of any given plant transformation protocol. The protocols presented in this edition represent the most efficient methods used in the laboratories of the contributors. They are by no means the only methods for successful transformation of your plant of interest.

The broad range of target tissue selection and in vitro culture procedures indicate the complexity in plant transformation. It is the intention of this book to facilitate the transfer of this rapidly developing technology to all researchers for use in both fundamental and applied biology. I take this opportunity to thank all my colleagues whose time and effort made this edition possible. Special thanks go to my family for their unconditional love and support during the process of editing this book.

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