Preface

From the early 1980s to the present, biotechnologies have yielded, with a great degree of success, the ability to genetically transform a wide variety of plant species. These plant transformation technologies have literally changed the face of agriculture and plant biology. Invariably, whenever any discussion ensues about developments in plant biotechnology with one of the pioneers of the field, especially in industry, we often hear stories of life on the frontier and excitement of breaking new ground in the 1980s. However, "all the really exciting research has already been done," we are told.

In February 2007, the International Conference on Plant Transformation Technologies was held in the beautiful city of Vienna, Austria. Over 300 participants from 47 countries learned that there was plenty of exciting plant biotechnology research in progress. In the course of the conference, research was presented by groundbreaking researchers, such as Dr. Mary-Dell Chilton, who demonstrated that there was still plenty left to do in plant transformation. Indeed, the editors of this volume were so convinced of this fact that we decided to invite many of the presenters and others to contribute to this volume, which gives a taste of the excitement we felt at the conference.

Thus, borrowing from the title of the Vienna conference, this book covers many topics on the cutting edge of transgenic plants. Of course, we are just really beginning to understand how the original methods of plant transformation, those using *Agrobacterium tumefaciens* and particle bombardment, truly work. Several chapters are reviews and updates on these technologies, and pertinent genomic interactions among organisms. Several other chapters present new vector systems and describe plasmids that we think will make a huge impact on making plant transformation more accessible for a wider variety of species. Indeed, this theme of accessibility and efficiency is prominent in chapters written by experts in their respective fields. It seems that plant biotechnology is becoming more egalitarian to more types of scientists—from molecular biologists, of course, but now accessible to ecologists and environmental scientists. Transformation technologies have played a huge role in this movement.

The upcoming frontier of challenges for biotechnology deals with issues of transgene precision and regulations. There is now a premium on minimizing the amount of transgenic DNA in plants while maximizing stability of gene expression and trait performance. For regulatory and commercial purposes, characterized integration of transgenes in known locations and precise expression patterns are viewed as helpful to target traits in predictable ways. Indeed, genetic engineering is better than genetic tinkering and transgenic technologies that maximize precision have increasing value in the world marketplace. Chapters were written on methods to gain higher precision of transgene integration and marker-free transformation. However, transgene silencing, either on purpose or by accident, which is one of the key research breakthroughs in recent years, is also important.

As we look to the future of plant biotechnology, we can envision new methods of transformation that could be more efficient and widen the breadth of species and genotypes that can be manipulated. Methods such as those using calcium alginate micro-beads and those targeting alternative cells, such as pollen grains, could be game-changers. In the future, nanotechnologies alone or coupled with established methods such as *Agrobacterium*-mediated transformation will likely be important contributors to biotechnology as well. The ever-expanding color pallet of fluorescent proteins and pigmented proteins will also likely be very useful as transformation tools and indicators of expression from the subcellular to ecological levels. Looming ahead are potentially greater regulatory hurdles and demands for safety beyond that required of traditional technologies. Thus, plant transformation technologies will be invented to serve dual purposes of increasing trait and crop value as well as biosafety. We believe that the most exciting times lie ahead in plant biotechnology as we plan for the second Plant Transformation Technologies conference held in Vienna February 2011.

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