Preface

Since the first transgenic plants were produced back in the early 1980s, there have been substantial developments towards the genetic engineering of most crops of our world. Initial studies using isolated plant cells and removing their cell walls to form protoplasts, offered the possibility of transferring genetic material by *Agrobacterium*-mediated gene transfer, chemical agents or electrical charges. However, in those cases were isolated protoplasts could be transformed, often, a shoot regeneration system was not available to induce the production of transgenic plants and any such regenerated plants were subject to mutation or chromosomal abnormalities. By the mid-1980s, the use of cultured plant organs, such as leaf disks, offered the convenience of combining gene transfer, plant regeneration and selection of transformants in a single system. This approach, enabled the production of stable, phenotypically-normal, transgenic potato and tomato plants in culture. By the late 1980s, the use of biolistics offered a means of inserting foreign genes into plant cells which where inaccessible to *Agrobacterium* infection. Even today, this technology is now standard practice for the production of some transgenic plants. Extensive research in the improvement of tissue culture conditions, development of new *Agrobacterium* strains and vectors, novel selectable marker genes and evaluations of various plant organs, tissues and cells towards shoot regeneration capability, in association with gene transfer technology enabled the more recalcitrant plants to be transformed. For example, the identification that the scutellum tissue of rice was both amenable to *Agrobacterium* infection and regenerable in culture from embryogenic calli, enabled the production of stably, transgenic rice plants by the mid-1990s. This discovery formed a platform towards the acceleration in gene transfer towards several major cereals. By the turn of the 21st Century, the use of *in planta* transformation strategies, such as floral-dipping, allowed the first transgenic pakchoi and radish plants to be produced without the necessity of tissue culture. To date, there remains considerable research to be undertaken to be able to routinely transform all the major crops. Indeed, many of the procedures described in the literature are often genotype-dependent. For this reason, a manual has been constructed which offers ideas and sometimes solutions towards extending the possibility of genetically modifying our desired germplasms.

The need to produce crops with improved agronomic traits is paramount in a world where more than 700 million people are undernourished and within the next 20 years the world's population will probably double. Transgenic plant technology offers one potential opportunity to improve crop production to help circumvent the need in the Third World. Recent developments in gene discovery and functional genomics should allow 'designer' crops to be grown in the field. In addition, such technology has great potential in facilitating novel approaches in genetics, biochemistry and physiology. Our food is produced from many countries of the globe. For this reason, *Transgenic Crops of the World – Essential Protocols*, contains contributions from many experts in the field of plant transformation across the world, describing a vast array of state-of-the-art methods in the production of genetically modified plants. Some chapters are review-orientated, the majority, gives detailed current and most versatile procedures known in the literature. Due to the lack of a single, genotype-independent system for most crops, in some chapters, we offer possibilities on how specified protocols could be modified to circumvent the transformation of specific genotypes. Such a designed manual should facilitate the production of transgenics in many laboratories involved in fundamental and applied biology. Finally, in the wake of environmental concerns over transgene dispersal via pollen, the use of antibiotic-free markers and chloroplast transformation systems are also described.

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Ian S. Curtis