Preface

Gene transfer is an essential technology for improving our understanding of gene structure and function. Although there are many methods by which DNA may be introduced into cells—including heat and chemical treatments, and microinjection—electroporation has been found to be the most versatile gene transfer technique. Electroporation is effective with a wide variety of cell types, including those that are difficult to transform by other means. For many cell types, electroporation is either the most efficient or the only means known to effect gene transfer. The early and broad success of electric field-mediated DNA transfer soon prompted researchers to investigate electroporation for transferring other types of molecules into cells, including RNA, enzymes, antibodies, and analytic dyes.

The first section of *Plant Cell Electroporation and Electrofusion Protocols* includes two chapters that serve as a guide to theoretical and practical aspects of electroporation, and will be of particular interest to those developing protocols for as yet untested species or cell types, and a third chapter that describes commercially available electroporation instruments. The remaining chapters describe well-tested protocols for DNA electrotransfection, electroporation of other biomolecules, or cell electrofusion. These chapters also include brief discussions of alternatives to electric field-based methods, citing the advantages and limitations of the various methods for achieving specific goals. Electroporation has become a favored method for introducing DNA into, and fusing plant cells, and as such these technologies promise to play a pivotal role in the development of more productive, hardy crop plants, and of plants resistant to insects and microbial pathogens. Of particular interest is the recently developed method for pollen electrotransformation, since this holds significant promise for making stably inherited changes in plants by direct modification of the germ line. Technologies for transforming plant cells lagged behind those for transforming microorganisms and animal cells. The advent of plant cell electrotransformation methods has had a strong impact on both basic and applied plant research.

Although electroporation procedures for different cell types are often similar, subtle differences in either electrical parameters or growth conditions can have strong effects on transfection or fusion efficiencies, and such factors are often important to control when optimum efficiencies are required. Each protocol, therefore, provides considerable detail about conditions for growing and preparing cell and tissue samples, with many helpful troubleshooting tips. Although widely used, electroporation is still a relatively young technology, and it is expected that this collection of protocols will both propel the electric field technologies forward and facilitate the growth in our understanding of the biological processes that these technologies are used to explore.

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