
Preface

Embryogenesis in higher plants, one of the different routes of morphogenesis of the plant kingdom, is a fascinating example of cellular totipotency. In fact, different kinds of plant cells (somatic, gametic, nucellar, and fertilized egg cells) are able to regenerate, in nature or in vitro, an entire organism through the formation of a somatic, gametic, or zygotic embryo, a bipolar structure without vascular connection with the surrounding tissue. In vitro somatic, gametic, and zygotic embryogenesis, apomixis, and secondary embryogenesis are actually valuable tools to support plant breeding, propagation, and conservation, with relevant implications to agriculture, forestry, horticulture, and preservation of plant genetic resources. Advances in plant biotechnology, and particularly in tissue culture, led in time to a better understanding of the physiological and biochemical bases regulating the process of plant embryogenesis, and to the establishment of more and more efficient protocols of in vitro embryo induction, maturation, and conversion to plant. Moreover, the recent molecular, genomic, and proteomic studies have produced additional valuable contributions to the comprehension of the in vitro embryogenic developmental process.

The intent of the book is to present an overview of recent advances, innovative applications, and future prospects of in vitro embryogenesis in higher plants by means of topical reviews and stepwise protocols of selected species. With this goal, the book has been divided into five parts. *Part I* contains reviews on general topics (microspore, zygotic and somatic embryogenesis, in vitro and in vivo asexual embryogenesis, advances on the genetic, physiological, and proteomic knowledge of somatic embryo formation, role of programmed cell death and mitochondria in somatic embryogenesis, and innovation in the use of bioreactors). The remaining part of the book contains stepwise protocols on somatic embryogenesis in selected horticultural plants (*Part II*) and forest trees (*Part III*), on gametic embryogenesis (*Part IV*), and on some pivotal topics (*Part V*), such as the detection of epigenetic modifications during microspore embryogenesis, the in vitro embryogenesis and plant regeneration from isolated zygotes, the synthetic seed production, the induction and maturation of somatic embryos, and the cryostorage of embryogenic cultures. Some useful “Notes,” a peculiarity of the series “Methods in Molecular Biology,” complete all the stepwise chapters, with additional information directly coming from the authors’ valuable daily experience in the tissue culture laboratory.

We are extremely grateful to all the authors for providing such excellent contributions, coming from their remarkable expertise on the different aspects of in vitro plant embryogenesis. It is our hope that this book will be a useful source of information and ideas for plant tissue culturists, cell biologists, embryologists, horticulturists, and operators of commercial nurseries. It is also our hope that it will attract students and young scientists toward the fascinating world of in vitro embryogenesis in higher plants.

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