

Preface

In simple terms, the application of technology to living organisms can be termed as biotechnology. During the last decade, the advancements in biology have led to the development of newer areas like cellular engineering, biochips and biomaterial science, stem cells, nanobiotechnology, etc.

The present book is restricted to the area of plant biotechnology, in particular, and attempts to expand only a few of the topics. Plant biotechnology had its beginning in the early twentieth century. It was in 1930's that Philip White and Roger Gautheret established plant cell culture systems. This was followed by the discovery of hormones, which led to the development of different techniques for the induction of cell cultures to differentiate into shoots, roots, or embryos in many plant systems—dicots and monocots. With the advent of recombinant DNA technology, and knowledge that accumulated related to the mode of transfer of DNA from *Agrobacterium* to the plants to induce cell division and gall formation, the field of plant transformation took birth and genetically engineered plants saw the light of the day. It is hoped that these technologies will greatly benefit the human kind by improving the yield of crop plants, horticulture produce, and the compounds having medicinal properties.

The book is divided into five sections. The first section deals with the methodology and bioresource generation. The techniques related to genetic engineering and gene transfer to the nuclear genome and chloroplast genome have been dealt with. The new techniques of genome profiling and gene silencing are also presented in two chapters. The importance and usefulness of the technology to preserve and utilize useful alleles in the wild germplasm is given in the chapter contributed by Cho *et al.*

The second section of the book deals with the classical aspect of plant biotechnology viz. tissue culture and micropropagation. There are eight chapters in this section, which bring out the usefulness and application of protoplast culture, microspore culture, *in vitro* regeneration and multiplication in cereals, bamboo, fruit, and foliage plants. This section also includes some reviews and original papers.

As mentioned above, genetic engineering via *Agrobacterium* has been standardized in a number of plants including cereals. In addition, direct transfer of DNA via particle bombardment has also been successful with many plants. Use of this technology to develop transformed plants in *Artemesia*, castor and orchids is given in the third section. In addition, a chapter by Soderquist and Lee reflects work on the production of recombinant proteins in plant cells.

The fourth section deals with the stress tolerance in plants. Both abiotic and biotic stresses put a very heavy penalty on the yield of many crop plants. Attempts to breed for these traits have limited success. It seems there is hope to improve tolerance in plants to both biotic and abiotic stresses using the modern biotechnological tools, and utilizing the knowledge generated via genetics

and genomics. The basic biology of some of the stress responses and designing plants for stress tolerance is discussed in this section.

The last section deals with medicinal plants. How to increase the alkaloid production, and how to manipulate pathways to increase the desired metabolite using tissue culture, micropropagation, genetic engineering etc. are some of the questions that have been discussed in various chapters in this section.

Although plant biotechnology encompasses many different areas, this book is designed to include chapters on a few of the selected topics of interest. The authors are given freedom to express their views and also to present data of their own. However, the editors have taken the liberty, with the know how of the authors, to review and revise the chapters to avoid presentation of any unsubstantiated data. We hope this book will be useful for the researchers to update their information on the topics dealt within this book in the area of Plant Biotechnology.

The present book is dedicated to Professor Dr. Karl-Hermann Neumann, Institut für Pflanzenernährung, Justus Liebig Universität, Giessen, Germany. One of us (Ashwani Kumar) had a chance to work with him under Alexander von Humboldt Foundation fellowship. Professor Dr. Neumann has been pioneer in introducing plant tissue culture in Germany, and has used this technique for solving various fundamental and applied problems of biology, especially understanding the mechanism of photosynthesis, hormone metabolism, nutrient uptake and cycling, growth regulation, DNA metabolism, genetic transformations and production of genetic vaccines.

We take pleasure to dedicate this book on his 70th birthday, and wish him a long and prosperous life.

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