
Preface

Gene silencing is being popularly used as a functional genomics tool to determine plant gene function. In addition, gene silencing is also used as one of the plant genetic engineering strategies to produce better crop varieties. It is anticipated that the use of gene silencing technology in commercial plant varieties will increase in the future. This volume will provide a comprehensive overview of various gene silencing methodologies and its applications.

Gene silencing can be either transcriptional gene silencing (TGS) or posttranscriptional gene silencing (PTGS). PTGS is more popularly used for gene function analyses. PTGS is commonly achieved by either RNA interference (RNAi) or virus-induced gene silencing (VIGS). RNAi in plants can be achieved by expressing hairpin RNA (hpRNA) that fold back to create a double-stranded RNA (dsRNA). These hpRNAs are potent inducers of PTGS and give rise to 21–23 nucleotides small interfering RNAs (siRNAs) derived from the dsRNA by RNase III-like enzymes called Dicers. Then the siRNAs assemble into endoribonuclease-containing complexes known as RNA-induced silencing complex (RISC). The siRNA strands subsequently guide the RISCs to complementary mRNA molecules, where they cleave and destroy the cognate mRNA thus causing PTGS. VIGS involves delivery of a fragment of plant gene (intended to be silenced) into plant cells via a recombinant virus. The plant defense mechanism silences both the targeted endogenous plant gene and the virus through PTGS. The plant RNA will be converted into dsRNA by RNA-dependent RNA polymerase. The dsRNA will then be degraded in a similar mechanism as that of RNAi. In addition to RNAi and VIGS, PTGS can also be induced by direct delivery of dsRNA into plants.

In addition to siRNA microRNA (miRNA) can also cause PTGS. miRNA-mediated PTGS is a natural targeted gene silencing phenomenon inherent in plants for gene regulation during plant development and stress responses. Some miRNAs trigger the production of secondary siRNAs from their targets. miRNA-induced gene silencing (MIGS) is an emerging field to silence more than one gene that may not have overall sequence similarity.

This volume will cover historical overview of gene silencing mechanisms in plants, vectors and strategies available for plant gene silencing, practical applications of gene silencing, and bioinformatics tools and other resources for plant gene silencing. In addition to these review articles, this volume will include methodology for VIGS in various different plant species, understanding plant stress responses using VIGS, miRNA identification, DNA interference, host-induced gene silencing, use of artificial miRNAs for gene silencing, high throughput RNAi, and others.

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