
Preface

The promoter is one of the fundamental elements for spatial and temporal gene expression regulation. Understanding its function has fascinated generations of scientists. Despite many other levels of gene expression regulation at the chromatin and post-transcriptional levels, the main prerequisite for expression is the promoter-driven transcription of the genes.

The detailed understanding of the regulatory elements required for transcription permits the *de novo* assembly of synthetic promoters by combining *cis*-regulatory elements with minimal promoter elements towards conferring new and specific transcription patterns in plants. Such synthetic promoters can be widely used in basic and applied research.

Fused to a reporter gene, the activity of a synthetic promoter can be monitored over time and space, thus adding to our understanding of promoter function and the function of the transcription factors interacting with specific *cis*-elements. In the applied field, synthetic promoters are useful to drive gene expression specifically for a desired purpose. This could be the expression of resistance genes in response to pathogen infection or the expression of genes for engineering or modifying metabolic pathways.

This book assembles experimental and bioinformatics protocols for the design and experimental testing of synthetic promoters. The identification of *cis*-regulatory elements potentially achieving the desired expression of a gene is at the core of synthetic promoter design. For this, several bioinformatics chapters are presented. The experimental verification of the proposed expression profile conferred by the *cis*-regulatory elements requires the assembly of synthetic promoters. Several chapters are dedicated to the assembly of synthetic promoters, also including specific software tools to facilitate promoter design. Transient and transgenic reporter gene technology is a prominent approach to test the spatial and temporal expression driven by synthetic promoters, and several chapters address this approach. In summary, this book covers all steps required from the identification of *cis*-regulatory elements, over synthetic promoter design, to the experimental analysis of synthetic promoter function.

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