Preface

Genetic approaches to understanding plant growth and development have always benefitted from screens that are simple, quantitative, and fast. Visual screens and morphometric analysis have yielded a plethora of interesting mutants and traits that have provided insight into complex regulatory pathways. Still, many genes within any given plant genome remain undefined. The premise underlying this book is that the higher the resolution of the phenotype analysis the more likely that new genes and complex interactions will be revealed. Recent advances in automation and highly sensitive analytical techniques have substantially expanded the plant biologist's toolbox with which to screen for mutants and traits and identify new genes. There are now centers and institutes dedicated to high-throughput phenotyping of plants, and it has been the subject of at least three international conferences to date. As always, the value of the data obtained through high-throughput phenotyping methods depends upon the experimental design, which is discussed here.

The methods described in this book can be generally classified as either quantitative profiling of cellular components, ranging from ions to small molecule metabolites and nuclear DNA, or image capture that ranges in resolution from chlorophyll fluorescence from leaves and time-lapse images of seedling shoots and roots to individual plants within a population at a field site. The sort of high-throughput analytical analysis described in these chapters will be relevant to plant researchers who rely on phenotype analysis to define gene function and characterize genome responses to the environment; this includes biochemists, molecular geneticists, ecologists, evolutionary biologists, and population geneticists. As robotics, computing, and imaging technologies all continue to advance at a rapid rate, the list of quantifiable assays that can be carried out in high-throughput and at high resolution will continue to expand, providing more tools to understand plant growth and development.

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