Preface

Ethylene was the first gaseous hormone discovered, and its discovery was prompted by the pronounced effects of "illuminating gas" on plant growth and development. Illuminating gas, a coal by-product, was piped throughout cities during the Victorian era as a fuel source for the lamps lighting streets and houses. Gas leaking from the pipes induced early senescence as well as leaf and petal abscission in nearby plants, which prompted a search for its active component. In 1901, Dimitry Neljubow demonstrated that this active component was the simple hydrocarbon ethylene. In the 1930s, Richard Gane established that plants produced their own ethylene, establishing ethylene as an endogenous plant growth regulator. Ethylene is now most popularly known for its role in controlling fruit ripening, but ethylene also regulates many other traits of agricultural significance including senescence, abscission, biomass, and responses to biotic and abiotic stresses. As such, ethylene continues to be a focus for worldwide research.

This volume in the *Methods in Molecular Biology* series provides a collection of protocols for the research scientist appropriate to the study of ethylene signaling in plants. Topics covered relate to ethylene biosynthesis, the signal transduction pathway, and the diverse ethylene responses of dicots and monocots. The section on ethylene biosynthesis includes six chapters, with techniques for the measurement of activities related to the biosynthetic enzymes ACC synthase and ACC oxidase, for quantifying the levels of ethylene synthesized by plants, as well as for the treatment of plants with exogenous ethylene. The section on the signal transduction pathway includes six chapters and focuses on the analysis of the novel membrane-associated proteins involved in the initial perception and transduction of the ethylene signal, including the ethylene receptors, CTR1 and EIN2. Many of these biochemical techniques were derived from work in Arabidopsis where these signaling elements were first discovered, but the approaches are readily transferable to the study of similar proteins in other species. The section on ethylene responses includes seven chapters covering assays applicable to dicots and monocots, including methods related to the roles of ethylene in germination, growth, abscission, abiotic stress, and defense. This section also includes information on Arabidopsis mutants and the variety of chemical inhibitors that affect ethylene responses.

The chapters follow the established format used throughout the *Methods in Molecular Biology*™ series. They include an Abstract, an Introduction, a detailed Materials section with lists of chemicals, buffers, and equipment, a step-by-step Methods section, as well as Notes and References. The Notes are often of particular use to investigators as these give additional background, provide alternative approaches, and describe potential difficulties and how these can be resolved. The protocols are intended for both experienced and beginning researchers, for those with prior experience in the study of ethylene signaling, and for those just entering this exciting research area.

The editors thank their "scientific parents": Michael Sussman who pushed them over the edge and down that slippery slope of plant membrane biochemistry and Tony Bleecker who enthusiastically introduced them to that deceptively simple hydrocarbon ethylene and the myriad effects it has on plants. The editors also thank all those colleagues who so willingly shared their protocols for this *Methods in Molecular Biology* volume on *Ethylene Signaling*.

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