Methods in ENZYMOLOGY

Volume 434

Lipidomics and Bioactive Lipids: Lipids and Cell Signaling

Edited by

H. Alex Brown

VOLUME FOUR HUNDRED AND THIRTY-FOUR

METHODS IN ENZYMOLOGY

Lipidomics and Bioactive Lipids: Lipids and Cell Signaling

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PREFACE

Lipid metabolism and cellular signaling are highly integrated processes that regulate cell growth, proliferation, and survival. Lipids have essential roles in cellular functions, including determinants of membrane structure, serving as docking sites for cytosolic proteins, and allosteric modulators. Abnormalities in lipid composition have established roles in human diseases, including diabetes, coronary disease, obesity, neurodegenerative diseases, and cancer. In the post-genomic era, we look at epigenetic factors and metabolomic biomarkers to better understand the molecular mechanisms of complex cellular processes and realize the benefits of personalized medicine.

Recent advances in lipid profiling and quantitative analysis provide an opportunity to define new roles of lipids in complex biological functions. Lipidomics was developed to be a systems biology approach to better understand contextual changes in lipid composition within an organelle, cell, or tissue as a result of challenge, stress, or metabolism. It provides an approach for determining precursor–product relationships as well as ordering the temporal and spatial events that constitute vital processes. This volume of *Methods in Enzymology* is one of a three-volume set on *Lipidomics and Bioactive Lipids* designed to provide state-of-the-art techniques in profiling and quantification of lipids using mass spectrometry and other analytical techniques used to determine the roles of lipids in cell function and disease. The first volume (432), *Mass-Spectrometry–Based Lipid Analysis,* provides current techniques to profile lipids using qualitative and quantitative approaches. The cell liposome is composed of thousands of molecular species of lipids; thus, generating a detailed description of the membrane composition presents both analytical and bioinformatic challenges. This volume includes the methodologies developed by the National Institute of General Medicine large-scale collaborative initiative, LIPID MAPS (www.lipidmaps.org), as well as an overview of international lipidomics projects. The second volume (433), *Specialized Analytical Methods and Lipids in Disease,* presents applications of lipid analysis to understanding disease processes, in addition to describing more specialized analytical approaches. The third volume (434), *Lipids and Cell Signaling,* is a series of chapters focused on lipid-signaling molecules and enzymes.

The goal of these volumes is to provide a guide to techniques used in profiling and quantification of cellular lipids with an emphasis on lipid signaling pathways. Many of the leaders in the emerging field of lipidomics have contributed to these volumes, and I am grateful for their comments in shaping the content. I hope that this guide will satisfy the needs of students

who are interested in lipid structure and function as well as experienced researchers. It must be noted that many of the solvents, reagents, and instrumentation described in these chapters have the potential to be harmful to health. Readers should consult material safety data sheets, follow instrument instructions, and be properly trained in laboratory procedures before attempting any of the methods described.

H. Alex Brown

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