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## Preface

Lipidomics is a sub-discipline of metabolomics and is defined as the large-scale study of non-water-soluble metabolites (lipids and lipidome) that utilize system-level analysis to characterize lipids and their interacting moieties (*1*). A literature search at the end of 2008 showed there were 200 articles published on lipidomics encompassing glycerophospholipids, sphingolipids, polyunsaturated fatty acids, glycolipids, sterol lipids, and proteolipids. It has been predicted that the combination of these lipid classes totals between 1,000 and 2,000 molecules. Lipids can also act as second messengers, or mitogens, and participate in profiling and signaling via specialized microdomains that have large amounts of lipids. When lipids are disturbed, their metabolites probably contribute to disease. In prostate cancer, for example, cyclooxygenase and lipoxygenase are upregulated reducing angiogenesis and tumor growth.

Early separation and identification of lipids started with TLC, and as technology advanced, it progressed to the use of GC and HPLC. Technical improvements to HPLC include reversed-phase methods, ESI, evaporative light scattering, electrochemical detection, APCI, suppressed conductivity and multi-dimensional electrophoresis. Other technologies coupled to chromatographic methods, such as MS/MS-MSn/MALDI/TOF, NMR, and MRM, provide a powerful approach to the global analysis of complex lipid mixtures, understanding structural changes through biophysical approaches and the effects of lipids on physiology, i.e. atherosclerosis. This has given us a clearer understanding of human and animal pathology, i.e. diabetes, cancer, neurodegeneration, and infectious disease. A new approach to measure oxidized lipids, referred to as “oxidative lipidomics,” has recently been described which provides methodology for separation and identification of these highly reactive lipids, especially in mitochondria. Many novel techniques are described in these volumes, including an imaging lipidomics approach. For another lipidomic approach of a lipid-derived radical technique, the reader is referred to Iwabashi, H., 2008. *Advanced Protocols in Oxidative Stress I*, volume 477, Chapter 6, Humana Press. In that same volume, a lipidomics technique for sphingolipids is also described, i.e. Wilder, AJ and Cowart, LA, Chapter 28.

The present volumes have taken a “shotgun” approach and are divided into seven parts in order to include as many different varieties of technology as possible. Chapters by international experts present a wide variety of reviewed as well as unpublished data on isolation techniques, structural analysis, lipid rafts, lipid trafficking and profiling, biomarkers, lipid peroxidation, biostatistics applied to lipids, software tools, and bioinformatics. These studies range from simple systems, such as in yeast, to complex biological models.

The ever increasing utilization of lipidomics will lead to more powerful technology, improved diagnostic–prognostic capabilities for medical disorders, and for the identification of new classes of lipids.

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## **Reference**

1. Wenk, M.R. 2005. The emerging field of lipidomics. Nature Reviews 4: 595–610.

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