Preface

Glycerophospholipids are amphipathic molecules that form the backbone of biological membranes, which are organized in bilayers and held together by hydrophobic, coulombic, and Van der Waal forces, and by hydrogen bonds. Biomembranes contain microdomains or lipid rafts that are rich in sphingolipids and cholesterol and serve as mobile platforms for signal transduction by clustering and organizing bilayer constituents including receptors, enzymes, and ion-channels. Thus, biomembranes are not simply inert physical barriers but are complex dynamic environments that regulate cellular function by modulating activities of membrane-bound enzymes, receptors, and ion channels.

Major advances in our understanding of signal transduction processes have occurred in last 20 years. A literature search on PubMed using the key word brain plus another key word illustrates the rapidly increasing interest in phospholipids and their metabolism in the brain (Table P-1). Although changes in the style of indexing at PubMed may skew these results, certainly the interest of researchers on phospholipids and phospholipases in the 5-year period increased at least 5-fold. The greatest increase was 14-fold for plasmalogen, indicating the realization of the very rapid turnover of these compounds and the role of choline plasmalogens (plasmenylcholine) as precursors of signaling molecules. We anticipate that this interest in research on brain phospholipids and phospholipases will continue at a rapid rate in coming years as more information on the composition of glycerophospholipid molecular species and the involvement of phospholipases in normal brain and the pathophysiology of neural trauma and neurodegenerative diseases becomes available.

Lipidomics and proteomics have emerged rapidly for the full characterization of the molecular species of phospholipids and for the enzymes associated with their metabolism. These techniques will be applied not only in whole brain, but also in neural membranes at cellular and subcellular levels as well as in biological fluids. These studies will help to understand the roles of phospholipid molecular species in gene expression, neural cell proliferation and differentiation, apoptosis, and maintenance of protein structure and function in normal brain, as well as in brain tissue from patients with neurological disorders. The phospholipases A_2 are a superfamily of enzymes that hydrolyze arachidonic acid and docosahexaenoic

TABLE P-1. PubMed search for papers with brain plus another keyword by year.

Other Keyword, Year	2000	2001	2002	2003	2004
Phospholipids	446	516	354	2871	5251
Phosphatidylcholine	136	141	79	714	1338
Plasmalogen	13	20	18	128	183
Phospholipase	268	293	236	763	2022
Phospholipases	186	211	171	594	1412
Phospholipase A_2	70	84	78	256	691
Phospholipase C	153	155	119	349	1092

This search was done on 31 March 2006.

acids from glycerophospholipids. These enzymes are involved in signal transduction, membrane homeostasis and remodeling, and neurodegeneration.

The main purpose of this book is to present readers with cutting edge information on glycerophospholipids and phospholipases A_2 and the generation of second messengers such as arachidonic and docosahexaenoic acids and their oxygenated metabolites (eicosanoids and docosanoids) in normal brain and brain from patients with neurological disorders. We attempt this in a form that is useful to students, teachers, and physicians, and to researchers in basic sciences, medicine, and the pharmaceutical industry. This book covers the involvement of phospholipases A_2 in neural trauma and neurodegenerative diseases and the therapeutic effects of phospholipase A_2 inhibitors in neurological disorders. These topics are of immense interest to neurochemists, neurologists, neuropharmacologists, and neurobiologists.

The book has 14 chapters. The first two chapters describe the metabolism of glycerophospholipids in brain, including those containing a vinyl ether group (plasmalogens). Chapters 3 and 4 cover innovative information on the properties and roles of phospholipases A_2 in the central nervous system. Chapters 5, 6, 7, 8, and 9 are devoted to the release of second messengers, such as arachidonic acid, docosahexaenoic acid, lyso glycerophospholipids, and lysophosphatidic acid, from neural membrane glycerophospholipids by phospholipases A_2 and their neurochemical effects on brain metabolism and function. Chapters 10 and 11 cover the involvement of phospholipases A_2 in neurological disorders, and the use of phospholipase A_2 inhibitors for the treatment of diseases associated with altered phospholipid metabolism. Chapter 12 describes the strengths and pitfalls of available methods for the assays of phospholipases A_2. Chapter 13 describes the association of phospholipases A_2 with neuropsychiatric disorders. Chapter 14 presents readers with future directions to follow to solve unresolved problems of brain phospholipid metabolism. Our choices of these topics are personal. They are based on our interests on phospholipid metabolism and phospholipases A_2 and on areas where major progress is being made. We hope that our attempt to consolidate the knowledge of glycerophospholipid metabolism and phospholipases A_2 in brain will provide the basis of more dramatic advances and developments on the roles of glycerophospholipid molecular species in the brain and on the consequences of altered glycerophospholipid metabolism in neurological disorders.

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