

METHODS IN MOLECULAR BIOLOGY

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Lipases and Phospholipases

Methods and Protocols

Second Edition

Edited by

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Preface

Lipases are nowadays the most applied enzymes in organic synthesis because of their broad substrate acceptance and because of the availability of the molecular, biochemical, thermodynamical, and solvent engineering tools, which allows the optimization of lipases and lipase-catalyzed reactions. We compile in this volume the arsenal of those tools and methods to succeed in your screening, optimization, and application of lipases.

On the other hand, phospholipases are also useful enzymes in food and pharmaceutical industries. As examples, their relationships with eicosanoids and protein kinases (and therefore their related diseases) are well known, and the quest for food-grade phospholipases is a current need of the food industry. This volume will guide you through the potential applications of phospholipases and their related methods.

Although many publications on both enzymes can be found in the research literature, this volume provides an update of fundamental issues, current and new applications as well as practical step-by-step protocols that were lacking, given the extensive applications of lipases and the potential application of phospholipases and its inhibitors.

The chapters contained within this volume were contributed either by recognized experts in the field or by promising young scientists, who kindly collaborated with their invaluable know-how and expertise. Chapters are well explained and written at an accessible level, so they can be easily read by both graduate students and skilled scientists.

The introductory chapters provide an overview on lipases and phospholipases, but also on esterases, which are often defined in the same terms as lipases.

The introduction section is followed by practical screening protocols and continuous methods to discover/target new or improved lipases and phospholipases.

A reemerging source of these enzymes—the plants—is also discussed, and a protocol for functional heterologous expression of plant lipases in yeast is presented. A new chapter on marine lipases and phospholipases activity measurement is introduced in this edition. Also, examples and case studies on cloning, production, purification, and characterization of selected lipases and phospholipases are presented.

In subsequent chapters, a review on heterologous expression systems for lipases is presented as a prelude to solid-state fermentation as a cheap method to produce lipases, followed by a chapter on synthetic biology as a new tool for lipase optimization. This section ends with a chapter on rational design strategy as a novel immobilization methodology for lipases and phospholipases.

Finally, eight applications of lipases and phospholipases are presented, either in traditional applications (food and lipids modifications), recently established applications (organic synthesis), or in new (biodiesel, biopolymers, and biosensors) emerging fields.

I would like to express my gratitude to all colleagues and Springer–Humana Press staff who contributed to the achievement of this book, starting with John Walker, the editor of this series, who besides giving us the opportunity to be part of this exciting project was always helpful and supportive along the editing process.

I also acknowledge the very efficient technical help from David Casey and the kind fund of some color figures by Patrick J. Marton, Senior Editor of Springer Protocols.

I am truly grateful to all the authors for their outstanding collaboration. It was a pleasure working with this team. Particular thanks to the members of the Advanced Biodiesel Cluster who contributed to nine chapters.

It is my hope that this volume will become the preferred updated reference book for the large scientific community working with lipases, phospholipases, and related enzymes.

Guadalajara, Jalisco, Mexico

Georgina Sandoval

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