Chapter

Introductory Chapter: Liposomes - Advances and Perspectives - My Point of View

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1. Introduction

Liposomes are vesicular arrangements composed of one or more phospholipid bilayers surrounding an aqueous core. Liposomes were discovered almost six decades ago. Due to its versatility, liposomes are now analyzed for their applicability both in laboratory techniques and in medical studies. Its interest lies in its ability to traverse cell membranes and to transport certain types of molecules to defined places in the human body.

Liposomes can carry both hydrophilic and hydrophobic molecules. The preparation of the liposomes results in different properties for these systems. There are several factors involved in the preparation of liposomes that can modify their structures. Due to its biological compatibility, nonimmunogenicity, greater solubility of chemotherapeutic agents, and its ability to encapsulate a wide variety of drugs, the supply of drugs using liposomes has meant a great advance. The purpose of this book is to focus on recent developments in liposomes. The chapters selected in this book are contributions from invited researchers with long experience in different areas of research. This book offers expert and updated reviews of the field of liposomes.

2. Brief history of liposomes

Liposomes were discovered in 1961 by Alec Bangham, a British scientist who studied blood coagulation. Bangham and RW Horne were testing the new electron microscope of the Agricultural Research Council Institute of Animal Physiology, Babraham, Cambridge, England, when they observed for the first time applying the negative staining technique for the study of the structures of the lipid phase that the dispersions of lecithin contained spherulites composed of concentric sheets [1]. These images served as the first evidence that the cell membrane was a two-layered lipid structure. The width of the lipid layer was estimated at 44 Å. Preparations of phosphatidylcholine-cholesterol of equal molar ratios were described as basically the same as phosphatidylcholine alone.

A year later, in a Cambridge pub, Weissmann in a discussion with Bangham called these structures “liposomes” in honor of the lysosome, a simple organelle whose latency linked to the structure could be interrupted with detergents and streptolysins. [2], and that his laboratory had been studying: liposomes can be easily distinguished from micelles and hexagonal lipid phases by transmission electron microscopy by negative staining [3].

3. My participation in studies with liposomes

Forty-four years ago, as an international scholar of the NIH in the Department of Biochemistry of the Health Center of the University of Connecticut, I carried out studies related to the mechanism of stearoyl-CoA desaturase [4]. That is where I first prepared liposomes by sonication of egg lecithin or dimyristoyl lecithin.

Since then I have used liposomes in multiple studies in order to analyze: the exchange of palmitic acid from cytosolic proteins to microsomes, mitochondria, and lipid vesicles [4]; the oleic acid transfer from microsomes to egg lecithin liposomes [5]; the interaction of albumin and fatty-acid-binding protein with membranes: oleic acid dissociation [6]; the removal of fatty acids but not phospholipids from microsomes liposomes and sonicated vesicles by fatty-acid-binding protein [7]; Fe^{2+}- and Fe^{3+}-initiated peroxidation of sonicated and nonsonicated liposomes made of retinal lipids in different aqueous media [8]; lipid peroxidation of membrane phospholipids in the vertebrate retina [9]; the antioxidant properties of melatonin and structural analogues on Fe(2+)-initiated peroxidation of sonicated liposomes made of retinal lipids [10]; the antioxidant behavior of melatonin and structural analogues during lipid peroxidation [11]; and the use of soybean phosphatidylcholine liposomes as model membranes to study lipid peroxidation photoinduced by pterin [12].

4. General remarks, conclusions, and perspectives

It has been fascinating to follow the field of liposomes research during almost five decades. From my experience, it is impossible to predict which aspects in liposomes research will dominate in the future.

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