

Structural Function of Asymmetric Chain N-Lignoceroylsphingosylphosphocholine (C24:0-SM) As Studied by Microcalorimetry and Electron Microscopy

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Recently (1997), a new aspect for cell membrane structure has been proposed. Thus, microdomains of a liquid-ordered state, generally known as rafts and caveolae, are formed within the cell membranes by the clustering of sphingolipids and cholesterol. In this regard, a large portion of the sphingolipids such as sphingomyelin and gangliosides has been reported to locate in the microdomains, and much attention of investigation has been paid to the sphingolipids.

However, since the early 1970's, the sphingomyelin (SM), the most typical sphingophospholipid, has been taken up as a research object of physicochemical studies, from the viewpoint of its sphingosine backbone different from a glycerol backbone of glycerophospholipids. In this connection, a naturally occurring SM has been reported to exist in a variety of molecular species differing in length of their acyl chain, in contrast with their sphingosine chain of mostly 18 carbons. However, the structural role of the acyl chain length difference observed over 10 carbons in lipid bilayers has been less well studied. For this, the following reason would be raised: commercially available synthetic SMs having a desired acyl chain are limited to some kinds of molecular species, and moreover, they are generally expensive. Accordingly, the semisynthesis has been selected in many works of this area, although it accompanies an epimerization of D-erythro to L-threo configurations, finally giving rise to a racemic SM.

In the present study, we pay our attention to the most asymmetric chain sphingomyelin, N-lignoceroylsphingosylphosphocholine (C24:0-SM). For comparison, two saturated symmetric chain SMs, N-palmitoylsphingosylphosphocholine (C16:0-SM) and N-stearoylsphingosylphosphocholine (C18:0-SM), were also semisynthesized. The present study reports structural and functional properties of the asymmetric chain SM in bilayers obtained by a microcalorimetry and a negative stain electron microscopy.