C. R. Chimie 15 (2012) 29–36

Contents lists available at ScienceDirect

Comptes Rendus Chimie

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Glycoside nucleoside lipids (GNLs): An intrusion into the glycolipids' world?

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ARTICLE INFO

Article history:
Received 6 May 2011
Accepted after revision 31 August 2011
Available online 7 October 2011

Keywords:
Amphiphile
Nucleoside
Lipid
Glycolipids
Glycoconjugates
Self-assembly
Liposomes

ABSTRACT

Glycoside nucleoside lipids (GNLs) are a new class of low-molecular-weight amphiphilic molecules capable of gelling either aqueous or organic solvents. This article provides an overview of some related lipid conjugate properties and the origin of the GNLs' discovery. Finally, recent biological results obtained with two different GNLs demonstrate the great variety of applications they may offer, and how they can find their place in the large glycolipids' community.

1. Introduction

Glycoside nucleoside lipids (or glycoside nucleolipids), also abbreviated as GNLs, are bioinspired molecules that belong to the large family of glycolipids. These compounds feature saccharides or oligosaccharides linked to a lipid moiety, either directly via the anomeric oxygen, or indirectly via a spacer unit such as glycerol (glycoglycerolipids), or sphingosine (glycosphingosines), for example. In the case of GNLs, a nucleoside is inserted between the lipid and the carbohydrate moiety (Fig. 1). Glycolipids are ubiquitous components of the living world in which they play important biological functions [1]. Recently, these compounds have been the object of increasing interest after the discovery of glycosphingolipids derived from a marine origin [2], which were able to activate natural killer T cells [3]. In this family, one of the most extensively studied glycoconjugate has been the α-GalCer – or KRN 7000 [4] – which is known for its antitumor effect on hepatic metastases [5]. Hence, many research groups are currently working on new KRN 7000 analogs [6]. From a biological point of view, carbohydrates and lipids are of primary importance: the former are involved in cell surface recognition while the latter constitute the cell membrane framework. Beside their biological properties, the combination of a polar carbohydrate moiety with a lipophilic part gives a natural amphiphilic character to the molecule. This characteristic, which induces the formation of self-assemblies, is also an important feature of GNLs. Glycolipids and glycosyl nucleolipids share partly the same structural features. Nevertheless, owning to the presence of the nucleoside, the glycosyl nucleolipids present additional H-bonding and π-stacking capabilities [7], which offer a new dimension for supramolecular chemistry. Indeed, these additional interactions allow the stabilization of new self-assembly morphologies, including

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1631-0748/$ – see front matter © 2011 Published by Elsevier Masson SAS on behalf of Académie des sciences.
doi:10.1016/j.crci.2011.08.010