

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/49552> holds various files of this Leiden University dissertation

Author: Mirzaian, Mina

Title: Analytical chemistry and biochemistry of glycosphingolipids : new developments and insights

Issue Date: 2017-06-14

Analytical chemistry and biochemistry of glycosphingolipids:

new developments and insights

Cover design and layout: Joost van den Broek (Studio Markant, Delft)

Original artwork cover: "Golden Ratio" by Bartłomiej Doroszko

Permission by Bartłomiej Doroszko to reproduce the art work as book cover

Oranje van Loon Drukkers, Den Haag

Copyright © 2017. Mina Mirzaian

All rights reserved. No part of this thesis may be reproduced, stored in a retrieval system, or transmitted in any form or by any means without permission of the author.

Analytical chemistry and biochemistry
of glycosphingolipids:
new developments and insights

PROEFSCHRIFT

ter verkrijging van
de graad van Doctor aan de Universiteit Leiden,
op gezag van Rector Magnificus prof. mr. C.J.J.M. Stolker,
volgens besluit van het College voor Promoties
te verdedigen op woensdag 14 juni 2017
klokke 11.15 uur

door

Mina Mirzaian

geboren te Sari, Iran

in 1963

Promotiecommissie

Promotoren: Prof. dr. J.M.F.G. Aerts
Prof. dr. J. Brouwer

Overige leden: Prof. dr. J. Bouwstra
Prof. dr. C.J. de Vries, Universiteit van Amsterdam
Prof. dr. V. Gieselmann, Friedrich-Wilhelms Universität Bonn
Prof. dr. G.A. van der Marel
Prof. dr. H.S. Overkleeft
Dr. J.D.C. Codee
Dr. M. van der Stelt
Dr. M.C. van Eijk

Table of Contents

Chapter 1	General introduction & Scope of thesis	1
Section I Quantitative detection of glycosphingolipids and sphingoid bases		
Chapter 2	Elevated globotriaosylsphingosine is a hallmark of Fabry disease <i>Proc Natl Acad Sci U S A. 2008 Feb 26;105(8):2812-7</i>	23
Chapter 3	Quantification of globotriaosylsphingosine in plasma and urine of Fabry patients by stable isotope ultraperformance liquid chromatography-tandem mass spectrometry <i>Clin Chem. 2013 Mar;59(3):547-56</i>	31
Chapter 4	Mass spectrometric quantification of glucosylsphingosine in plasma and urine of type 1 Gaucher patients using an isotope standard <i>Blood Cells Mol Dis. 2015 Apr;54(4):307-14</i>	45
Chapter 5	Quantification of sulfatides and lysosulfatides in tissues and body fluids by liquid chromatography-tandem mass spectrometry <i>J Lipid Res. 2015 Apr;56(4):936-43</i>	57
Chapter 6	Accurate quantification of sphingosine-1-phosphate in normal and Fabry disease plasma, cells and tissues by LC-MS/MS with ¹³ C-encoded natural S1P as internal standard <i>Clin Chim Acta. 2016 May 21;459:36-44</i>	71
Chapter 7	Simultaneous quantitation of sphingoid bases by UPLC-ESI-MS/MS with identical ¹³ C-encoded internal standards <i>Clin Chim Acta. 2017 Jan 13;466:178-184</i>	87
Section II Clinical applications of glycosphingolipid measurements		
Chapter 8	Gaucher disease and Fabry disease: new markers and insights in pathophysiology for two distinct glycosphingolipidosis <i>Biochim Biophys Acta. 2014 May;1841(5):811-25</i>	103
Chapter 9	Summary of applications (Addendum II)	121
Section III Fundamental investigations on glycosphingolipid metabolism		
Chapter 10	Adapting to a deficient glycosphingolipid-degrading lysosomal glycosidase – hypothesis review <i>Manuscript pending submission</i>	127
Chapter 11	Lysosomal glycosphingolipid catabolism by acid ceramidase: formation of glycosphingoid bases during deficiency of glycosidases <i>FEBS Lett. 2016 Mar;590(6):716-25</i>	153
Chapter 12	Lyso-glycosphingolipid abnormalities in different murine models of lysosomal storage disorders <i>Mol Genet Metab. 2016 Feb;117(2):186-93</i>	167
Chapter 13	LIMP2 deficiency-associated lipid abnormalities in mice <i>Manuscript pending submission</i>	179
Chapter 14	Glucosylated cholesterol in mammalian cells and tissues: formation and degradation by multiple cellular β -glucosidases <i>J Lipid Res. 2016 Mar;57(3):451-63</i>	209

Chapter 15	β -Xylosidase and transxylosylase activities of human glucocerebrosidase <i>Manuscript pending submission</i>	229
	General discussion and perspectives for future research	247
	Summary	259
Appendices		
Addendum I	Synthesis of a Panel of Carbon-13-Labelled (Glyco)Sphingolipids <i>Eur. J. Org. Chem. 2015 Apr;12:2661-2677</i>	269
Addendum II	Long-term effect of antibodies against infused alpha-galactosidase A in Fabry disease on plasma and urinary (lyso)Gb3 reduction and treatment outcome <i>PLoS One. 2012;7(10):e47805</i>	275
	Consequences of a global enzyme shortage of agalsidase beta in adult Dutch Fabry patients <i>Orphanet J Rare Dis. 2011 Oct 31;6:69</i>	276
	Biochemical response to substrate reduction therapy versus enzyme replacement therapy in Gaucher disease type 1 patients <i>Orphanet J Rare Dis. 2016 Mar 24;11:28</i>	277
	Lentiviral gene therapy using cellular promoters cures type 1 Gaucher disease in mice <i>Mol Ther. 2015 May;23(5):835-44</i>	278
Addendum III	Reducing GBA2 Activity Ameliorates Neuropathology in Niemann-Pick Type C Mice <i>PLoS One. 2015 Aug 14;10(8):e0135889</i>	281
	Samenvatting	285
	List of publications	291
	Curriculum Vitae	293
	Acknowledgements	295