

University of Groningen

## Paving ways for personalizing drug therapy during pregnancy

Daud, Nur

**IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.**

*Document Version*

Publisher's PDF, also known as Version of record

*Publication date:*

2017

[Link to publication in University of Groningen/UMCG research database](#)

*Citation for published version (APA):*

Daud, N. (2017). *Paving ways for personalizing drug therapy during pregnancy: A focus on the risk of drug teratogenicity*. Rijksuniversiteit Groningen.

### Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

### Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

*Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.*

# **Paving ways for personalizing drug therapy during pregnancy**

*A focus on the risk of drug teratogenicity*

Nur Aizati Athirah Daud

ISBN 978-90-367-9641-5 (printed version)  
ISBN 978-90-367-9640-8 (electronic version)

Author: Nur Aizati Athirah Daud  
Cover: Nur Aizati Athirah Daud (concept) and Gherasim Florin (graphic design)  
Lay-out: Nurul 'Azyyati Sabri  
Printed by: Ipskamp Printing

The publication of this thesis was financially supported by the Research Institute SHARE (Science in Healthy Ageing and healthcaRE), University Medical Center Groningen/University of Groningen and the Ministry of Education, Malaysia. The funding from University Sains Malaysia is gratefully acknowledged.

Copyright ©Nur Aizati Athirah Daud, Groningen 2017.  
All rights reserved. No part of this thesis may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying, recording, or by any information storage or retrieval system, without written permission of the author. The copyright of previously published chapters of this thesis remains with the publisher or journal.



rijksuniversiteit  
 groningen

# Paving ways for personalizing drug therapy during pregnancy

A focus on the risk of drug teratogenicity

PhD thesis

To obtain the degree of PhD at the  
 University of Groningen  
 on the authority of the  
 Rector Magnificus Prof. E. Sterken  
 and in accordance with  
 the decision by the College of Deans.

This thesis will be defended in public on

Monday 24 April 2017 at 12.45 hours

by

**Nur Aizati Athirah Daud**

born on 27 December 1985  
 In Kelantan, Malaysia

**Supervisor**

Prof. dr. Bob Wilffert

**Co-supervisor**

Dr. Jorieke E.H. Bergman

**Assessment committee**

Prof. dr. Eugène P. van Puijenbroek

Prof. dr. Toine C.G. Egberts

Prof. dr. Régine P.M. Steegers-Theunissen

*untuk Amir & Natrah..*

**Paranymphs:**

Nurul Nadiah Hamidon

Heleen van der Meer

# CONTENTS

Chapter 1	General introduction	11
<b>PART A</b>	<b>The role of transporter proteins in drug-induced birth defects</b>	
Chapter 2	P-glycoprotein-mediated drug interactions in pregnancy & the changes on the risk of congenital anomalies: A case-reference study <i>Drug Safety 2015</i>	30
Chapter 3	Maternal use of drug substrates of placental transporters and the effect of transporter-mediated drug interactions on the risk of congenital anomalies <i>PLOS ONE 2017</i>	50
Chapter 4	Pharmacogenetics of drug-induced birth defects: the role of polymorphisms of placental transporter proteins <i>Pharmacogenomics 2014</i>	70
<b>PART B</b>	<b>Pharmacogenetic predictors associated with the risk of drug teratogenicity</b>	
Chapter 5	Knowledge and attitude of formerly pregnant women regarding pharmacogenetics, and their willingness to participate in pharmacogenetic research <i>BMC Pregnancy and Childbirth 2017</i>	98
Chapter 6	The risk of congenital heart anomalies following prenatal exposure to serotonin reuptake inhibitors- is pharmacogenetics the key? <i>International Journal of Molecular Sciences 2016</i>	116
Chapter 7	Prenatal exposure to serotonin reuptake inhibitors and congenital heart anomalies: An exploratory gene-environment interaction study <i>Submitted</i>	144
Chapter 8	General discussion	168
Addendum	Appendices	184
	Summary	215
	Samenvatting	218
	Acknowledgement	221
	List of publications	224
	Research Institute SHARE	226
	About the author	228