



UvA-DARE (Digital Academic Repository)

Omics-guided precision medicine

Microbiomics and breathomics in asthma phenotyping

Ibrahim, M.I.A.

Publication date

2022

[Link to publication](#)

Citation for published version (APA):

Ibrahim, M. I. A. (2022). *Omics-guided precision medicine: Microbiomics and breathomics in asthma phenotyping*. [Thesis, fully internal, Universiteit van Amsterdam].

General rights

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), other than for strictly personal, individual use, unless the work is under an open content license (like Creative Commons).

Disclaimer/Complaints regulations

If you believe that digital publication of certain material infringes any of your rights or (privacy) interests, please let the Library know, stating your reasons. In case of a legitimate complaint, the Library will make the material inaccessible and/or remove it from the website. Please Ask the Library: <https://uba.uva.nl/en/contact>, or a letter to: Library of the University of Amsterdam, Secretariat, Singel 425, 1012 WP Amsterdam, The Netherlands. You will be contacted as soon as possible.

**Omic-guided precision medicine:
microbiomics and breathomics in asthma
phenotyping**

Mahmoud Ismael Abdelaziz Ibrahim

Colophon

Omics-guided precision medicine: microbiomics and breathomics in asthma phenotyping

PhD thesis, University of Amsterdam, the Netherlands.

ISBN 978-94-93270-23-7

Cover Yousra Mohamed

Layout Guus Gijben | Proefschrift-aio.nl

Printing AIO | Proefschrift-aio.nl

The researcher Mahmoud Ismael Abdelaziz Ibrahim is funded by a full scholarship from the Ministry of Higher Education of the Arab Republic of Egypt.

©Mahmoud I. Abdel-Aziz, Amsterdam 2021

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system of any nature, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission in writing from the copyright owner.

Omics-guided precision medicine: microbiomics and breathomics in asthma phenotyping

ACADEMISCH PROEFSCHRIFT

ter verkrijging van de graad van doctor
aan de Universiteit van Amsterdam
op gezag van de Rector Magnificus
prof. dr. ir. K.I.J. Maex

ten overstaan van een door het College voor Promoties ingestelde commissie,
in het openbaar te verdedigen in de Agnietenkapel
op woensdag 19 januari 2022, te 16.00 uur

door
Mahmoud Ismael Abdelaziz Ibrahim
geboren te Assiut

Promotiecommissie:

<i>Promotores:</i>	prof. dr. A.H. Maitland-van der Zee	AMC-UvA
	prof. dr. A.D. Kraneveld	Universiteit Utrecht
<i>Copromotores:</i>	dr. A.H. van Stuyvenberg-Neerincx	AMC-UvA
	dr. S.J.H. Vijverberg	AMC-UvA
<i>Overige leden:</i>	prof. dr. W.J. Wiersinga	AMC-UvA
	dr. E.G. Haarman	AMC-UvA
	prof. dr. H.J. Bogaard	Vrije Universiteit Amsterdam
	prof. dr. L. Koenderman	Universiteit Utrecht
	prof. dr. J. Garssen	Universiteit Utrecht
	dr. E.M. Kemper	AMC-UvA

Faculteit der Geneeskunde

To my dearest family; Nariman, Yassin and Younus

To my beloved parents, peace be upon them

Table of Contents

Part 1: Introduction		9
Chapter 1.1	General introduction	11
Chapter 1.2	Omics for the future in asthma	23
Part 2: The microbiome in asthma phenotyping		53
Chapter 2.1	The crosstalk between microbiome and asthma: Exploring associations and challenges	55
Chapter 2.2	Sputum microbiome profiles identify severe asthma phenotypes of relative stability at 12-18 months	93
Chapter 2.3	A multi-omics approach to delineate sputum metagenomics and eicosanoids-associated asthma inflammatory phenotypes	121
Chapter 2.4	Association of endopeptidases, involved in SARS-CoV-2 infection, with microbial aggravation in sputum of severe asthma	179
Part 3: The breathome in asthma phenotyping		189
Chapter 3.1	eNose breath prints as a surrogate biomarker for classifying patients with asthma by atopy	191
Chapter 3.2	Cross-sectional biomarker comparisons in asthma monitoring using a longitudinal design: The eNose premise	215

Part 4: General discussion and summary	225
Chapter 4.1 General discussion	227
Chapter 4.2 Summary	249
Chapter 4.3 Nederlandse samenvatting	257

Appendices	
PhD portfolio	266
List of publications	268
Curriculum vitae	272
Acknowledgments	274