University of Groningen

On a quest for metabolic fluxes: sampling and inference tools using thermodynamics, metabolome and labelling data

Taborda Saldida Alves, Joana

DOI:

[10.33612/diss.157440136](https://doi.org/10.33612/diss.157440136)

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:

2021

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

Citation for published version (APA):

Taborda Saldida Alves, J. (2021). *On a quest for metabolic fluxes: sampling and inference tools using thermodynamics, metabolome and labelling data*. [Thesis fully internal (DIV), University of Groningen]. University of Groningen. <https://doi.org/10.33612/diss.157440136>

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).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

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.

**On a quest for metabolic
fluxes: sampling
and inference tools
using thermodynamics,
metabolome
and labelling data**

Joana Isabel Taborda Saldida Alves

The work published in this thesis was carried out in the research group Molecular Systems Biology of the Groningen Biomolecular Science and Biotechnology Institute (GBB) of the University of Groningen in the Netherlands. The research was financially supported by the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No 675585.

ISBN: 978-94-6421-211-2

Cover design: Inês Avelar Silva

Layout: Emmanuel Páez Pérez

Printed by: Ipskamp

Copyright © 2021 Joana Saldida

All rights reserved. No part of this publication may be reproduced, stored in a retrievable system of any nature, or transmitted in any form or by any means, electronic, mechanical, including photocopying and recording, without prior written permission of the author.

university of
groningen

On a quest for metabolic fluxes: sampling and inference tools using thermodynamics, metabolome and labelling data

PhD thesis

to obtain the degree of PhD at the
University of Groningen
on the authority of the
Rector Magnificus Prof. C. Wijmenga
and in accordance with
the decision by the College of Deans.

This thesis will be defended in public on

Friday 19 February 2021 at 12.45 hours

by

Joana Isabel Taborda Saldida Alves

born on 21 January 1992
in Lisboa, Portugal

Supervisors

Prof. M. Heinemann

Co-supervisor

Dr. A. Miliadis Argeitis

Assessment Committee

Prof. B. Jayawardhana

Prof. B.M. Bakker

Prof. J. Zanghellini

Aos meus pais

CONTENTS

12	Chapter 1
	Inference of steady-state metabolic fluxes
	Research question and outline of this thesis
42	Chapter 2
	Estimating metabolic fluxes and their uncertainty
	with thermodynamics, metabolome and labelling data
220	Chapter 3
	Benchmarking Monte Carlo methods for sampling
	of thermodynamically feasible fluxes
270	Chapter 4
	Conclusions and future perspectives
278	Summary
280	Nederlandse samenvatting
283	Acknowledgements