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Microbiome-mediated colonization resistance: defense against enteropathogens and multi-drug resistant organisms

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Romy, like Ed, you have been instrumental in many of the chapters in this PhD thesis and for my development as a scientist in the past four years. You have been the ideal co-promotor for me during this PhD trajectory, as you always gave me complete freedom to explore my own interests and research directions, while still providing critical and useful feedback. In addition, I could always freely discuss any concerns I had with you. Thank you for all the support, ideas and the great supervision.

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Paola, we did not have the easiest ride during my PhD time. There were far too many hours and days that we spent in the hospital, but I am extremely grateful and happy that you have recovered so well. I am very proud of, and impressed with, how you got your life back on track after such a trajectory. To many more happy and healthy years together!

List of Publications

1. Nooij S, **Ducarmon QR**, Laros JFJ, Zwittink RD, Norman JM, Smits WK, Verspaget HW, Keller JJ, Terveer EM, Kuijper; working group of the Netherlands Donor Feces Bank. Faecal microbiota transplantation influences procarcinogenic *Escherichia coli* in recipient recurrent *Clostridioides difficile* patients. *Gastroenterology*. 2021 Oct;161(4):1218-1228.e5. doi: 10.1053/j.gastro.2021.06.009. Epub 2021 Jun 11.
2. Mesnage R, Teixeira M, Mandrioli D, Falcioni L, Ibragim M, **Ducarmon QR**, Zwittink RD, Amiel C, Panoff JM, Bourne E, Savage E, Mein CA, Belpoggi, F, Antoniou MN. Multi-omics phenotyping of the gut-liver axis reveals metabolic perturbations from a low-dose pesticide mixture in rats. *Commun Biol*. 2021 Apr 14;4(1):471. doi: 10.1038/s42003-021-01990-w.
3. **Ducarmon QR***, Terveer EM*, Nooij S, Bloem MN, Vendrik KEW, Caljouw MAA, Sanders IMJG, van Dorp SM, Wong MC, Zwittink RD*, Kuijper EJ*. Microbiota-associated risk factors for asymptomatic gut colonisation of multi-drug-resistant organisms in a Dutch nursing home. *Genome Med*. 2021 Apr 7;13(1):54. doi: 10.1186/s13073-021-00869-z. *These authors contributed equally
4. **Ducarmon QR**, Kuijper EJ, Olle B. Opportunities and Challenges in Development of Live Biotherapeutic Products To Fight Infections. *J Infect Dis*. 2021 Jun 16;223(Supplement_3):S283-S289. doi: 10.1093/infdis/jiaa779.
5. Mesnage R, Teixeira M, Mandrioli D, Falcioni L, **Ducarmon QR**, Zwittink RD, Mazzacuva F, Caldewell A, Halket J, Amiel C, Panoff JM, Belpoggi, F, Antoniou MN. Use of Shotgun Metagenomics and Metabolomics to Evaluate the Impact of Glyphosate or Roundup MON 52276 on the Gut Microbiota and Serum Metabolome of Sprague-Dawley Rats. *Environ Health Perspect*. 2021 Jan;129(1):17005. doi: 10.1289/EHP6990. Epub 2021 Jan 27.
6. Goloso-Gulbat MJ, **Ducarmon QR**, Tan RCA, Zwittink RD, Kuijper EJ, Nacis JS, Santos NLC. Gut microbiota and dietary intake of normal-weight and overweight Filipino children. *Microorganisms*. 2020;8(7):E1015. Published 2020 Jul 8. doi:10.3390/microorganisms8071015
7. **Ducarmon QR**, Hornung BVH, Geelen AR, Kuijper EJ, Zwittink RD. Towards standards in clinical microbiota studies: comparison of three DNA extraction methods and two bioinformatic pipelines. *mSystems*. Feb 2020, 5 (1) e00547-19; doi: 10.1128/mSystems.00547-19.
8. Crobach MJT*, **Ducarmon, QR***, Terveer, EM, Harmanus, C, Sanders, IMJG, Verduin, KM, Kuijper, EJ*, Zwittink, RD*. The Bacterial Gut Microbiota of Adult Patients Infected, Colonized or Noncolonized by *Clostridioides difficile*. *Microorganisms*. 2020 May, 6;8(5):677. doi: 10.3390/microorganisms8050677. *These authors contributed equally
9. **Ducarmon QR**, Hoogerwerf MA, Janse JJ, Geelen AR, Koopman JPR, Zwittink RD,

- Goeman JJ, Kuijper EJ, Roestenberg M. Dynamics of the bacterial gut microbiota during controlled human infection with *Necator americanus* larvae. *Gut Microbes*. 2020 Nov 9;12(1):1-15. doi: 10.1080/19490976.2020.1840764.
10. Vendrik KEW, Ooijevaar RE, de Jong PRC, Laman JD, van Oosten BW, van Hilten JJ, **Ducarmon QR**, Keller JJ, Kuijper EJ, Contarino MF. Fecal microbiota transplantation in neurological disorders. *Front Cell Infect Microbiol*. 2020;10:98. Published 2020 Mar 24. doi:10.3389/fcimb.2020.00098
 11. **Ducarmon QR**, Zwitterink RD, Hornung BVH, van Schaik W, Young VB, Kuijper EJ. Gut Microbiota and Colonization Resistance against Bacterial Enteric Infection. *Microbiol Mol Biol Rev*. 2019;83(3):e00007-19. Published 2019 Jun 5. doi:10.1128/MMBR.00007-19
 12. Hornung BVH, Zwitterink RD, **Ducarmon QR**, Kuijper EJ. Response to: ‘Circulating microbiome in blood of different circulatory compartments’ by Schierwagen *et al*. *Gut*. 2020 Apr;69(4):789-790. doi: 10.1136/gutjnl-2019-318601. Epub 2019 Apr 6.

PhD Portfolio

PhD student:	Quinten R. Ducarmon
LUMC	Medical Microbiology
department:	
Promotor:	prof. dr. Ed J. Kuijper
Copromotor:	dr. Romy D. Zwartink
Research programme:	Molecular basis of bacterial pathogenesis, virulence factors and antibiotic resistance
Title of Thesis:	Microbiome-mediated colonization resistance: defense against enteropathogens and multi-drug resistant organisms

PhD training	Year	Hours
Mandatory courses		
PhD Introductory Meeting	2018	5
BROK Course	2018	42
Basic Methods and Reasoning in Biostatistics	2018	42
Generic/disciplinary courses		
Data and Projectmanagement	2018	28
Practical Linux	2018	11
MGC Technology Facilities course	2018	42
Code and data management with Git	2018	14
Using R for data analysis	2018	32
Open & Reproducible Microbiome Data Analysis	2018	28
RNASeq course data analysis	2018	56
How to make an academic poster	2018	8
ICME 10 (Hands-on training in Prokaryotic and Eukaryotic metagenomics)	2019	40
Analysis of Repeated Measurements	2019	42
Negotiation for PhDs	2020	8
Machine learning for bioinformatics & systems biology	2019	84
Multimomics Data Integration in R	2020	56
Attended lectures and participation in meetings		
Lecture Series Micropia	2018	10
Sentinal Surveillance voor <i>Clostridium difficile</i> infectie meeting	2018	4
Gut Day	2018	8
Gut Day	2019	8
Congress attendance and poster or oral presentations		
Scientific Spring Meeting KNVMM & NVMM	2018	16
Scientific Spring Meeting KNVMM & NVMM	2019	16
ECCMID	2019	32

PhD training	Year	Hours
Congress attendance and poster or oral presentations		
Exploring Human Host-Microbiome Interactions in Health and Disease	2019	24
Scientific Spring Meeting KNVMM & NVMM	2021	16
ECCMID	2021	32
Grants and Awards		
FEMS Travel Grant		
FEMS Research & Training Grant		
Poster Prize (Runner-up) at Exploring Human Host-Microbiome Interactions in Health and Disease, 2019.		

Curriculum vitae

Quinten Ducarmon was born on March 8th, 1994 in Terneuzen, the Netherlands. After graduating from 'S.S.G. De Rede' in 2011, he started the Pre-Med program at University College Roosevelt (UCR) and graduated *cum laude* in January 2015. During these years, he also became an International Master in chess and participated, amongst others, in the World Junior Championship in 2014 in Pune, India. He obtained an MSc degree in Nutrition and Health at Wageningen University & Research (WUR) with a specialization in Nutritional Physiology. During his MSc, he performed an internship at the Systems Biology group at Netherlands Organisation for Applied Scientific Research (TNO) which focused on the effect of a nutritional intervention on the gut microbiome. This is where his interest in the role of the microbiome in health and disease was really triggered. In January 2018 he started his PhD research at LUMC's Center for Microbiome Analyses and Therapeutics (CMAT) under supervision of prof. dr. Ed Kuijper and dr. Romy Zwartink. Here, Quinten focused on studying the role of the microbiome in providing colonization resistance against enteropathogens and multi-drug resistant organisms and this topic allowed for various collaborations, both in and outside of the LUMC. In early 2021, Quinten spent four months at the European Molecular Biology Laboratory (EMBL) in Heidelberg in the group of dr. Zeller, where he developed the first computational tool capable of directly profiling carbohydrate-active enzymes from human gut metagenomes. He will continue his academic career as a postdoctoral researcher in the group of dr. Zeller. Together with Paola Flores, Quinten lives in Oegstgeest.

