WETENSCHAPPEN & BIO-INGENIEURSWETENSCHAPPEN

The Research Group of

Industrial Microbiology and Food Biotechnology (IMDO)

has the honour to invite you to the public PhD defence of

MSc. Marija Selak

to obtain the degree of Doctor of Bioengineering Sciences

The role of bifidobacteria in prebiotic fermentation and butyrate production through cross-feeding to improve gut health

Promotor:

Prof. Dr. ir. Luc De Vuyst

The defence will take place on

Thursday, June 3, 2021, at 16.00 h

Given the COVID-19 regulations, the defence will take place online.

Contact Louise.Vermote@vub.be to get a link to follow this defence via a livestream.

Members of the jury

Prof. Dr. ir. Wim VERSÉES (VUB, chairman)
Prof. Dr. ir. Damya LAOUI (VUB, secretary)
Prof. Dr. ir. Frédéric LEROY (VUB)
Prof. Dr. Sebastiaan EELTINK (VUB)
Prof. Dr. Apo. Kristin VERBEKE (TARGID, KU Leuven)
Prof. Dr. Irena ROGELJ (Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia)

Curriculum vitae

Marija Selak was born on March 15, 1986, in Kranj (Slovenia). She graduated from the Gimnazija Želimlje, Želimlje, Slovenia, in 2005. She obtained her degree in Microbiology from the Biotechnical Faculty of the University of Ljubljana (Ljubljana, Slovenia) in 2011. In October 2011, she started her PhD in the Research Group of Industrial Microbiology and Food Biotechnology (IMDO) of the Vrije Universiteit Brussel, under the supervision of Prof. Dr. ir. Luc De Vuyst, with a PhD fellowship of the Vrije Universiteit Brussel in the framework of a bilateral agreement with the University of Ljubljana. Her research dealt with the role of bifidobacteria in the butyrogenic effect of prebiotics. She is (co-)author of six scientific papers published in peer-reviewed international journals. She participated at six national and international conferences where she presented her research results as posters and gave two oral presentations.

Abstract of the PhD research

The human gut microbiota is being investigated in terms of composition, function, and interactions among colon bacteria to be able to accomplish desirable health effects through the diet, possibly on the individual level.

This PhD thesis focused on the stimulation of beneficial bifidobacterial and butyrate-producing colon bacterial fermentation with prebiotic inulin-type fructans (ITF), which results in an increase of favourable short-chain fatty acids, in particular butyrate. These so-called bifidogenic and butyrogenic effects were studied with bifidobacterial strains that were isolated from different human intestinal regions and sources, both biopsies of different regions in the human intestines and different colon vessels of the simulator of the human intestinal microbial ecosystem (SHIME® reactor). Four clusters of different types of ITF degradation fingerprints were found, which was species- and colon region-independent, suggesting cooperation for ITF degradation among bifidobacteria along the human colon. These strain-specific degradation mechanisms also occurred within one individual, indicating resource partitioning. Furthermore, they existed among bifidobacterial strains originating from the same colon region, underlining strain co-existence and cooperation.

Finally, to further understand the bifidogenic and butyrogenic effects of ITF in the human colon on strain level, cross-feeding interactions with less studied butyrate-producing colon bacteria, in particular *Roseburia* species, were studied. Either the initial degradation of inulin was performed by a bifidobacterial strain that produced acetate, which allowed the butyrate-producing roseburial strain to grow on released mono- and disaccharides, or both bifidobacterial and roseburial strains degrading inulin reciprocally exchanged degradation products and metabolites.

Overall, this study resulted in a better knowledge of the mechanisms behind the bifidogenic and butyrogenic effects of ITF and of the importance of the strain-specific ITF degradation capacity of bifidobacteria involved in cross-feeding interactions with butyrate-producing colon bacteria. It may allow to predict the outcome of these interactions, although the *in vivo* impact of an ITF-enriched diet may rely on the individual's colon composition of bifidobacterial and butyrate-producing bacterial communities. Therefore, more investigations are needed on the interactions between recently isolated human colon bacteria, in the presence of prebiotic fibres, to further unravel the beneficial outcomes of colon fermentation and cross-feeding for human health.