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Expanding the human bacterial repertoire: initial results from the Vaccine Immunomodulation throughout the Aging Lifespan (VITAL) clinical trial

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Abstract

A paradigm shift in the vaccine field is the recognition that vaccines have non-targeted 'non-specific' effects (NSEs) on the immune system, beyond the induction of vaccine specific adaptive immunity. The gut microbiome significantly affects the development and regulation of the immune system. Therefore, its composition may affect the individual response to vaccination.

Two vaccines recommended for the elderly are the annual seasonal influenza vaccine (sIV) and the Diphtheria Tetanus and acellular Pertussis (DTaP) vaccine. The double blinded VITAL human trial, involving 400 young and elderly volunteers from Tasmania, Australia, is designed to assess the NSEs of these vaccines on the immune system of the young and elderly. Participants were immunized with DTap followed by sIV, sIV alone or DTap concurrently with the sIV. Herein we present initial assessment of the gastrointestinal microbiota (n=74) from the VITAL cohort.

Baseline faecal samples from 74 patients were collected and sequenced with shotgun metagenomic sequencing. This patient cohort had an alpha diversity with an average Shannon's diversity index of 4.45 while beta diversity showed no significant variance amongst the patient cohort. Taxonomic classification against the Human Gastrointestinal Bacteria Genome Collection identified 61 out of 74 patient samples with unclassified rates greater than 30%. To investigate the novel species within this cohort, 5 patient samples with high levels of unclassified reads (>50%) were selected to perform bacterial culturing. Our 16S rRNA sequencing analysis on the resulting purified isolates identified 17 putative novel species. Expanding the availability of genome sequenced bacterial isolates will provide a valuable resource to further characterize the ecology of human microbial communities, which is paramount for the study of individual responses to vaccination.

Biography

Jennifer Boer is a postdoctoral researcher at RMIT, committed to the study of vaccines in different disease contexts. To this effect she has progressed to acquire cross-disciplinary expertise in bioinformatics, neuroscience, and immunology. Jennifer has completed her bachelor in Biotechnology at the University of Tor Vergata in Rome, after which she moved to the Netherlands to complete a Research Master in Behavioural and Cognitive Neuroscience, majoring in clinical and molecular neuroscience. During her masters she completed a research project in Vancouver at the University of British Colombia after which she was offered a PhD position at the University Medical Centre of Groningen in the Netherlands. Here she investigated the use of a bacterial compound as a therapeutic option for malignant brain tumours. Following the completion of her PhD, she moved to Melbourne where she is currently studying how to optimize vaccination benefits in the elderly in a large scale human trial in Tasmania, with immediate translational potential, using a systems vaccinology approach.

Publication

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