

The host-archaeome interaction

Summary

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Supervisor: Prof. Dr. Christine Moissl-Eichinger
Availability: This position is available.
Offered by: Medical University of Graz
Application deadline: Applications are accepted between August 14, 2020 00:00 and October 10, 2020 23:59 (Europe/Zurich)

Description

Background:

The composition of the microbial community associated with the human body and its relevance for human health and disease has become a subject of intense research during the last years. Trillions of microorganisms are associated with the human body inside the gastrointestinal tract (GIT), mouth cave, vagina and on our skin. However, the human microbiome is composed of various microorganisms, including archaea. Due to the focus on the bacteriome in the large majority of microbiome studies, the role of archaea in human disease is still unclear¹. The biggest question that we are trying to answer is: What is the contribution of archaea to human health and can we identify causal links between health effects and specific archaeomes or species?

Hypothesis and Objectives:

Hypothesis: The composition and genomic inventory of archaea within the human body is dependant on body physiology and age, and is mediated by a specific interaction with immune cells.

Objectives: In this project, we will specifically analyse the archaeomes of (healthy) middle-aged subjects (n=100) and elderlies (n=100) from already available samples and datasets. Archaeal genomic information (gene- and genome-centric) will be derived, and mechanistic/physiological networks with bacteria and other microorganisms will be analyzed in detail. Archaeal genomic information will be used to delineate genomic and biological adaptations for positive and negative interaction with the human body. This information will further be applied for specific exposure experiments with immune cells (i.e. macrophages, dendritic cells...) in collaboration with the Division of Immunology and Pathophysiology and the Medical University of Graz and collaboration partners in Borstel and Kiel, Germany, in which we will deepen our knowledge on specific immune-reaction towards archaeal isolates².

Methodology:

The following methods will be applied, beyond standard microbiology methodology: Amplicon-based microbiome and archaeome analysis, metagenomics, microbiome-focused bioinformatics, genome-binning and annotation, correlation analysis, anaerobic cultivation, cell-culture, quantitative PCR/digital PCR, cell assays, visualization via microscopy/fluorescence *in situ* hybridization. The portfolio also includes conceptualization and writing of scientific publications, presentations at international conferences and science communications.

Preliminary experience in some of these methods is an advantage.

References:

1. Borrel, G., Brugère, J., Gribaldo, S. *et al.* The host-associated archaeome. *Nat Rev Microbiol* (2020). <https://doi.org/10.1038/s41579-020-0407-y>

2. Vierbuchen, Tim, et al. "The human-associated archaeon *Methanosphaera stadtmanae* is recognized through its RNA and induces TLR8-dependent NLRP3 inflammasome activation." *Frontiers in immunology* 8 (2017): 1535.



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