

2017 Helmholtz – OCPC – Programme

for the involvement of postdocs in bilateral collaboration projects

PART A

Title of the project: Phages in human health and phage therapy

Helmholtz Centre and institute: Institute of Virology, Helmholtz Zentrum Munich

Project leader: Dr. Li Deng and Professor Ulrike Protzer

Web-address: <https://www.helmholtz-muenchen.de/viro/>

Description of the project (max. 1 page):

As German Research Center for Environmental Health, Helmholtz Zentrum Munich pursues the goal of developing personalized medical approaches for the prevention and therapy of major common diseases. On the base of results obtained in molecular studies, the institute of Virology develops novel diagnostic and therapeutic concepts against viral infections, and uses viruses as therapeutic tools. Focusing on bacterial viruses (phages), the group 'Viruses in Nature and Human Health' uses an integrated approach to investigate microbes-viruses interactions by combining microcosm experiments employing model microbes and viruses, and culture-independent, high-throughput metagenomics.

The role of the human microbiome for maintenance of health resp. development of infectious, but also noninfectious chronic diseases is increasingly recognized. However, an important group of the spectrum – phages – is largely overlooked in the human microbiome. Although during the last years diverse phenomena critical to the biology of microbes have been described to be driven by phages in Nature, and they are now considered as ubiquitous players that impact microbial communities through mortality and horizontal gene transfer to modulate microbial metabolism. The view that phages are “only” parasites is no longer valid but phages rather are able to transfer and store genetic information of their hosts and to some extent, regulate the metabolism of their host.

In this project, we seek to understand the overall impact of environmental factor driving the structure of phages colonizing the various human organs, especially lung surface, and to investigate their impacts on human health and diseases development. Various cutting-edge omics tools (e.g. viral-tagged metagenomics, transcriptomics) will be applied.

Further the efforts to develop treatment strategies aiming on manipulating bacterial community structure for promotion of human health increase. One option is phage therapy, i.e. the application of lytic viruses attacking specifically bacteria. Extracellular signaling (Quorum sensing, QS) orchestrates bacterial behavior on population level and is thus a major driver in sociomicrobiology. It is a critical factor for the impact of the bacteria on their host as many extracellular virulence factors are QS induced. Recently we and others detected that QS can be connected with anti-phage defense in the same bacterium in various ways, e.g. with and without employing CrisprCas. cBased on this, this project will also tackle the influence of phage diversity in a patient on the potential success of a phage therapy, as well as the potential to combine with anti-QS drugs.

The research project will be tightly integrated with many other projects currently persuaded in the research groups, which will facilitate the exchange and a fast progression.

Furthermore, we offer an innovative, well-equipped, well-founded, and scientifically stimulating surrounding and a broad range of training opportunities.

Description of existing or sought Chinese collaboration partner institute (max. half page):

Chinese Universities or institutions with strong programme and expertise in either the general science and technology, or medical oriented are welcome to apply. The expertises in the following list are beneficial: (1) bioinformatics, (2) molecular biology or virology, (3) biotechnology especially synthetic biology.

Required qualification of the post-doc:

Aim of this project is to analyze the human phage metagenomes, as well as the interplay of different phages which are affected by the QS in distinct ways and their hosts. For this purpose, candidates either with intensive experience of bioinformatics, especially microbial metagenomics or viral metagenomics, or experience of molecular biology and virology are encouraged to apply.

- PhD in: bioinformatics, molecular biology or virology
- Experience with: intensive experience of bioinformatics, especially microbial metagenomics or viral metagenomics, or intensive experience of molecular biology and virology
- Additional skills in: Flow cytometry, or yeast artificial chromosome platform