Comparative Microbiome Analyses

Highlight / Publication:
Dirk Schulze-Makuch, Dirk Wagner, Samuel P. Kounaves, Kai Mangelsdorf, Kevin G. Devine, Jean-Pierre de Vera, **Philippe Schmitt-Kopplin**, Hans-Peter Grossart, Victor Parro, Martin Kaupenjohann, Albert Galy, Beate Schneider, Alessandro Airo, Jan Frösler, Alfonso F. Davila, Felix L. Arens, Luis Cáceres, Francisco Solís Cornejo, Daniel Carrizo, Lewis Dartnell, Jocelyne DiRuggiero, Markus Flury, Lars Ganzert, Mark O. Gessner, Peter Grathwohl, **Lisa Guan**, Jacob Heinz, Matthias Hess, Frank Keppler, Deborah Maus, Christopher P. McKay, Rainer U. Meckenstock, Wren Montgomery, Elizabeth A. Oberlin, Alexander J. Probst, **Johan S. Sáenz**, Tobias Sattler, Janosch Schirmack, Mark A. Sephton, **Michael Schloter**, **Jenny Uhl**, Bernardita Valenzuela, **Gisle Vestergaard**, Lars Wörmer and Pedro Zamorano
Transitory microbial habitat in the hyperarid Atacama Desert; PNAS March 13, 2018. 115 (11) 2670-2675; published ahead of print February 26, 2018.
https://doi.org/10.1073/pnas.1714341115

PSP Element:
G-504700-001

Person to contact for further enquiries:
Schloter, Michael; schloter@helmholtz-muenchen.de; 2304

Keywords:
Microbiome, Metabolome, Metagenome, Atacama desert; borders of life

Central statement of the highlight in one sentence:
We could show that indigenous microbial communities are present and temporally active in soils of the Atacama Desert (Chile), which is considered as the driest place on earth.

Text of the highlight:
Traces of life are nearly ubiquitous on Earth. However, a central unresolved question is whether these traces always indicate an active microbial community or whether, in extreme environments, such as hyperarid deserts, they instead reflect just dormant or dead cells. Although microbial biomass and diversity decrease with increasing aridity in the Atacama Desert, we provide multiple lines of evidence for the presence of an at times metabolically active, microbial community in one of the driest places on Earth. We base this observation on four major lines of evidence: (i) a physico-chemical characterization of the soil habitability after an exceptional rain event, (ii) identified biomolecules indicative of potentially active cells [e.g., presence of ATP, phospholipid fatty acids (PLFAs), metabolites, and enzymatic activity], (iii) measurements of in situ replication rates of genomes of uncultivated bacteria reconstructed from selected samples, and (iv) microbial community patterns specific to soil parameters and depths. We infer that the microbial populations have undergone selection and adaptation in response to their specific soil microenvironment and in particular to the degree of aridity. Collectively, our results highlight that even the hyperarid Atacama Desert can provide a habitable environment for microorganisms that allows them to become metabolically active following an episodic increase in moisture and that once it decreases, so does the activity of the microbiota. These results have implications for the prospect of life on other planets

such as Mars, which has transitioned from an earlier wetter environment to today's extreme hyperaridity.

Taking account of the HMGU mission:
Microbiomes are important drivers for ecosystem services in nature and strongly trigger human health. Thus, an in depth understanding on the response pattern of microbiomes towards stressors like drought is essential to estimate boarders for important ecosystem services.

The internal HMGU co-operation partners with whom the highlight was compiled, if appropriate:
Prof. Dr. Philippe Schmitt-Kopplin (BGC)