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Europlanet Distributed Planetary Simulation and Sample Analysis Facility:

The Center for Microbial Life Detection

Christine Moissl-Eichinger and Kaisa Koskinen
Medical University of Graz, Austria (christine.moissl-eichinger@medunigraz.at)

Abstract

Within the Europlanet activity, the Center for microbial Life Detection at the Medical University of Graz in Austria offers expertise in detection of microbial signatures, analysis thereof and microbial cultivation.

1. Introduction

Our involved team members have large experience with microbial detection and quantification in samples from extreme environments and the growth of microbial specialists in (pure) cultures (e.g. anaerobes). Specifically we offer:

• Life detection in environmental and appropriate clinical samples (support in DNA extraction, selection of appropriate primers for bacteria, archaea and fungi, polymerase chain reaction (PCR), if desired in combination with propidium monoazide staining (detection of intact cells only), amplicon-sequencing and diversity data analysis, quantification of bacteria, archaea and fungi. If needed, -OMICS technologies can be applied.

• For the life detection workflow e.g. Next Generation Sequencing (Illumina MiSeq) for nucleic acid characterization, Gas Chromatography - Mass Spectrometry (GC-MS) for short fatty acids determination or scanning electron microscope SEM ZEISS DSM 950 for ultrastructure analysis.

• Detection of microbial cells: Domain to genus-specific fluorescence in situ hybridization, probe design and selection, visualization using confocal laser scanning microscopy (CLSM).

• Cultivation of specific microbial specialists, such as anaerobes or oligotrophs for use in laboratory experiments at the host's institution.

• Support in data analysis includes graphical display of e.g. microbial diversity and interpretation of results with respect to the metabolic capabilities of the microbiome and the possible impact on the habitat.

2. Our visitors and projects

To date, ten researcher teams from all over Europe have visited our facilities and processed a variety of different microorganisms and samples during their stay. Those included extreme cave, lake and volcano samples, Antarctic ice, samples from space-related indoor environments, such as the MARS500 mock-up spacecraft or samples from the HISEAS encapsulation experiment. We were successful to gain insights into the microbial diversity thriving in these samples, with potential impact on the ecology of the respective ecosystem or the human crew. In the following, two representative projects are presented in more detail.

a. Su Bentu limestone cave in Sardinia, Italy

This project was performed together mainly with researchers from DLR, Cologne, Germany and Italy. By the analyses in our laboratory, we could show human impact was confined to locations that are utilized as campsites and that exploration leaves only little microbial trails. Moreover, we uncovered a specialized microbiome, specifically adapted to survive in such an extreme environment with low nutrient availability [1].

b. The confined Mars500 habitat

This project was performed together with the University of Edinburgh and the DLR, Cologne. The Mars500 project was created to simulate a full duration crewed return flight to Mars. For 520 days, six crew members lived enclosed in the mock-up spacecraft and took 360 samples from 20 locations at 18 time-points. All samples were processed during the visitor's stay in our laboratory, and insights into the microbial dynamics during the Mars500 mission were obtained. Our results revealed that under

confined conditions the community composition remains highly dynamic and microbes adapt quickly to environmental changes. The results serve as an important data collection for future risk estimations of crewed space flight and help to plan spacecraft missions with appropriate monitoring and countermeasures on board [2].

3. Summary and Conclusions

The Europlanet activity allowed us to create and accomplish projects together with researchers all over Europe. We are now aiming to increase our activities and our possibilities, as novel instruments have been installed. This includes digital PCR, optimized OMICS technologies, scanning electron microscopy and available hardware and software for improved data analysis.

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References

[1] Leuko, S., Koskinen, K., Sanna, L., D'Angeli, I.M., De Waele, J., Marcia, P., Moissl-Eichinger, C. and Rettberg, P., 2017. The influence of human exploration on the microbial community structure and ammonia oxidizing potential of the Su Bentu limestone cave in Sardinia, Italy. PLoS One, 12(7), p.e0180700.

[2] Schwendner, P., Mahnert, A., Koskinen, K., Moissl-Eichinger, C., Barczyk, S., Wirth, R., Berg, G. and Rettberg, P., 2017. Preparing for the crewed Mars journey: microbiota dynamics in the confined Mars500 habitat during simulated Mars flight and landing. Microbiome, 5(1), p.129.