



Biosignature profiling for astrobiology by *in situ* immunosensor-based instrumentation

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Immunosensors have been used for many years for environmental and clinical applications. Antibodies or antibody-like molecules have also been proposed during the last years for the detection of biomarkers in Astrobiology (1-3), and the European Space Agency (ESA) considered very positively an antibody-based instrument (Life Marker Chip-LMC) as part of the Pasteur Payload for the Exomars mission (4). We reported a LMC-like instrument called SOLID (for “Signs Of Life Detector”; 5), and a field prototype (SOLID2) has successfully been tested several times, specially during a joint CAB-NASA Mars drilling simulation project called MARTE (6, 7). Herein we report a shotgun approach for antibody production for biomarker detection in astrobiology, testing of 155 new polyclonal antibodies against different bacteria and natural samples (water, sediments, soil, biofilms, etc) from Mars analog environments, as well as the construction and validation of a Life Detector Chip (LDCHIP200) with more than 200 antibodies for monitoring the presence of such bacteria or some of their remains. Some of the antibodies produced against iron and sulfur rich environmental samples (from Rio Tinto) reacted specifically with biological polymers from samples taken around the world (Antarctica, Yellowstone, 4 km deep mine in South Africa or Iceland). This means that the samples are sharing common, probably universal, biomarkers. Each sample can be defined by its specific “immunopattern”, that is, its response to the 200 antibody containing LDCHIP. Clustering analysis allowed us to group samples by its

similarity, which means similar biomarkers. We propose our LCHIP200, not only as a “yes” or “not” answer but as a powerful tool for sample profiling. The LDCHIP200 is the core immunosensor for SOLID V3.0, an instrument for *in situ* analysis composed of two separate units: a Sample Preparation Unit (SPU) for 10 samples and a Sample Analysis Unit (SAU) to assay the samples supplied either by SPU or by other instrument.

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