Microbiome reveals history of human-interactions in the museum - a pilot project

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This pioneer project aims to develop methods for assessing the microbiome of heritage and art objects. The proposal is lead in partnership by Stefan Simon and Johannes Vogel. Johannes Vogel is Director General at The Museum für Naturkunde – Leibniz Institute for Evolution and Biodiversity Science in Berlin, which is an integrated research museum within the Leibniz Association and one of the most important research institutions worldwide in the areas of biological and geological evolution and biodiversity. Stefan Simon is Director of the Rathgen Research Laboratory in Berlin, which is believed to be the oldest museum laboratory in the world, and the research institute for the National Museums on issues related to conservation, art technology and archaeometry. Project partners are the Leibniz Institute DSMZ, Braunschweig (Cecilia G. Flocco, Jörg Overmann) and Baylor College of Medicine, Houston, TX (Lukas Simon).
Our guiding question is: Can the microbiome inform us about the environment in which the object was created, collected or stored?

To answer this question, the project aims to develop a set of best practice methods for sampling and analyzing microbiomes on heritage objects, focusing on non-invasive sampling methods, microbial profiling (DNA-sequencing, cultivation) and data analysis.
As biology in art and cultural heritage, it will open a new scientific approach to analyzing and interpreting heritage collections and, here specifically addressing and investigating questions of authenticity and provenance.

As art in biology, it will contribute to the understanding of microbiomes and the interactions between organisms and objects. Depending on the identified microbial profiles, results might even have an impact on health and safety issues within museums.
For initial analysis, a list of art objects ranging in material and size was defined. Selection of the objects was motivated by optimizing the signal-to-noise ratio. Objects of comparable material yet with varying degrees of exposure to human interaction were prioritized. Initial sampling (61 samples) at the Pergamon Museum and the Museum für Naturkunde took place in October 2020. Sampling was carried out with certified DNA-free and sterile nylon flocked swabs. To extract sufficient information from these low-input samples library preparation methodology was optimized by DMSZ researchers. Samples were subsequently subjected to 16S rRNA amplicon sequencing. Machine learning techniques were applied to separate biological signal from controls as performed at Baylor College of Medicine, Houston, TX. Our initial results demonstrated that we were able to distinguish the microbiome signature between frequently touched and untouched objects thus revealing the human fingerprint on the objects. Further analyses are currently undertaken and their outcomes will be presented during the conference.