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The biogeography of dust in the Eastern Mediterranean

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The atmospheric microbiome, the aerobiome, is a complex mixture of suspended microorganisms originating from different environments, e.g., soil, marine environments, and plants. Aerobiomes sampled around the globe show distinct compositions, yet some common features might be observed. Defining these similarities and differences contribute to our understanding of this environment. In this talk I will describe a metagenomic study of microorganisms found in samples of atmospheric dust collected in Israel. These samples originate from different sources and have different atmospheric trajectories. The metagenomes were compared to publicly-available atmospheric metagenomes, as well as to marine and soil metagenomes from the Eastern Mediterranean region. This study helps elucidate the role of dust storms in replenishing the atmosphere with bacteria, fungi and archaea, which facilitate essential biogeochemical processes, by investigating microbiomes and functional genes from dust metagenomes. Our results reveal a high level of similarity between metagenomes of dust sampled in Israel and metagenomes of dust collected in Saudi Arabia asynchronically. Moreover, by identifying taxa and genes that are correlated with PM concentrations, we suggest a possible "core" atmospheric microbiome composed mainly of fungi. Application of the SourceTracker algorithm revealed an inverse correlation between the "core" aerobiome and the fraction of soil-derived bacteria and archaea in the dust metagenomes. Marine microbiomes contributed very little to the dust microbiome, even in dust that traversed the Mediterranean and Red Seas. The dust metagenomes showed a high relative abundance of genes associated with antibiotic resistance, sporulation and the ability to degrade aromatic pollutants, which could not be traced to any of the natural microbiomes that were examined. This study represents an important step toward integrating the knowledge accumulated on the global aerobiome and reveals the important role of duststorms in contributing to the presence of various environmentally relevant microbial functions.

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