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EDITORIAL

Special Collection on Pollution, Bioremediation, and the Environment

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We are living in the Anthropocene, an epoch, which is characterized by a strong impact of human actions on our environment. One of the most serious threats that we are facing is the changes in terrestrial as well as aquatic ecosystems in response to the release of chemical compounds, with so far, in most cases, unknown consequences for the quality of the respective ecosystems, the provided ecosystem services, and finally, also human health. This is acknowledged in the One Health concept and in the UN SDGs.

Indeed, in the last century, the number of chemical compounds produced synthetically has almost increased by the factor of 1000. Most of these compounds end up after use in our environment and impact the biota living there. Significant losses of biodiversity on all trophic levels are the consequence, which become more severe when interacting with climate change.

In this respect, microbes are of key interest, as they change, on the one hand, if affected, interactions of trophic levels as well as ecosystem services to a large extent, and on the other hand, may be the key drivers for the degradation of chemical compounds and the subsequent mineralization. Even for hardly degradable compounds like PAH, microbes have been described which degrade the materials either as sole carbon source or co-metabolically and may as a consequence benefit from the presence of these compounds in nature. Whereas this knowledge is mostly based on laboratory studies under optimal, in nature, the situation is far more complex, as here, for example, low availabilities of nitrogen or phosphorous might contradict findings from in vitro experiments. Here, often far more complex interactions of microbiota with different functional traits might be needed for the degradation of chemical compounds compared to simple studies in the laboratory. Further in nature, the typical situation is not the presence of a single contaminant but far more the presence of cocktails of chemicals which interfere with microbial actions to a so far unpredictable manner.

This fascinating role of microbes in contaminated environments, being affected by chemicals but also partly benefiting from their application, motivated us to raise a special issue in Microbial Ecology. There was a tremendous response to the launch of this collection, and we reviewed more than 40 manuscripts and finally accepted 13 papers for publication spanning a range of focal areas including the role of microorganisms in toxic environments, bioremediation processes, interaction of climate change and pollutants, and recent discussions on microplastics and other nanomaterials. We tried to cover a wide range of topics from the molecular view on single genes and their induction to single organisms as well as complete microbiomes and their interactions as well as ecosystems and possible new equilibria formed because of pollution.

We consider this as a timely effort to collect recent data, as analytical tools in the last year to analyze microbial communities and their function using molecular DNA-based tools become more and more sensitive. Today, we can use molecular data even to reconstruct the genomes of single microorganisms in silico, which are considered as keystone taxa in a particular environment without having them cultured beforehand. This allows subsequently for new targeted isolation-based approaches getting new microbiota in hands which can be used for basic science on the first glance but later on also to define synthetic microbial communities (SynComs), which can be used as inoculants to help an environment to better scope with chemical pollutants and stressors.

In the following, we give some highlights which will have been included into the special issue:

In the manuscript entitled ***Polyurethane-Degrading Potential of Alkaline Groundwater Bacteria***, Ciric and colleagues [1] discuss the impact of the accumulation of toxic compounds in water environments. Samples were collected

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from alkaline groundwater to isolate and identify bacteria with plastic- and lignocellulose-degrading potential. Genera belonging to *Pseudomonas*, *Acidovorax*, *Kocuria*, and *Methylotenera* grew on at least three of the tested plastic and lignocellulosic substrates used in the study.

In ***Deciphering the role of WWTPs in cold environments as hotspots for the dissemination of antibiotic resistance genes***, Perez-Bou and colleagues [2] look at the resistomes of wastewater treatment plants (WWTPs) that are located at temperatures below 5 °C in cold environments. They observed high abundances of genes associated with antibiotic resistance in these influents and associated activated sludge, suggesting that WWTPs that are located in these environments could be "hotspots" for the dissemination of ARGs that could increase resistance to commonly prescribed antibiotics.

In ***Marine Heatwave Caused Differentiated Dysbiosis in Photosymbiont Assemblages of Corals and Hydrocorals During El Niño 2015/2016*** [3], the authors describe the significant impact of climate change on corals including bleaching events which can result in the death of coral reefs on a global scale. They investigated what temperature changes can do to the coral *Mussismilia harttii* and the hydrocoral *Millepora alcicornis* which were monitored through the El Niño 2015/2016. A severe bleaching event resulted from a < 3 °C-week heatwave, but no mortality was detected, with *M. alcicornis* more susceptible having earlier symptoms and a longer bleaching event. New symbionts were observed after bleaching events. The study highlights differences in responses to temperature and bleaching by different coral species in their native environments.

Finally, in ***Microplastics Biodegradation by Estuarine and Landfill Microbiomes***, Cavaleiro and colleagues investigated the capabilities of landfill leachate and estuarine sediments to degrade polyethylene, polyethylene terephthalate, and polycaprolactone, under aerobic, anaerobic, thermophilic, and mesophilic conditions. The identified species were capable of accelerating degration of some of these compounds [4].

We hope you enjoy this collection, which we believe contributes sound scientific knowledge and awareness needed to advance this field. As greater awareness of the level of toxic compounds in our environments continues, the impact to our health and our environment needs to be considered with a One Health approach. Let us continue to spur interests and opportunities for the next generation of scientists who our planet depends on.

References

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