Microbial ecotoxicology: an emerging discipline facing contemporary environmental threats

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This special issue of ESPR is focused on microbial ecotoxicology. What is ‘microbial ecotoxicology’?

It is a branch of science that studies both (i) the ecological impacts of chemical (synthetic or natural origin) or biological (toxic species) pollution at the microbial scale and on the various functions that they ensure in the ecosystems and (ii) the role of microbial communities in the ecodynamic of the pollutants (source, transfer, degradation, transformation). It is a multidisciplinary scientific endeavor at the crossroad between microbial ecology, microbial toxicology, physics and chemistry (Fig. 1). It responds to an increasing demand worldwide of the politics and society because of the threat on environmental and human health caused by intense anthropogenic activities. In the context of the Anthropocene, microbial ecotoxicology seeks not only to conduct fundamental researches to understand the impact of pollutants on microbial processes and vice versa but also to carry out applied researches to provide tools readily usable by the society to monitor the evolution of the quality of the environment and to restore polluted sites.

Why is it important to consider the microbial biosphere in ecotoxicology?

The history of microbial ecotoxicology pops up recently (Ghiglione et al. 2014) decades after the emergence of ecotoxicology (Truhaut 1977). Such investigation arose because of tremendous technological breakthroughs in the last decades by applying molecular tools such as next-generation sequencing giving new insight in estimating the abundance, structure and diversity of microbial community in complex environments (Tautz et al. 2010, Ghiglione et al. 2012). Because microbial ecologists demonstrated that microbial life is very diverse and plays a primary role in supporting various ecosystem functions in virtually all of our planet’s environments (Barton and Northup 2011), microbial ecotoxicologists go beyond the restricted use of model organisms generally used in toxicology, preferentially performing investigations at community level. This statement is nicely illustrated by the word cloud generated from title words and keywords in this special issue (Fig. 2). Microbial ecotoxicology paves the way to assess the impacts of contaminants on taxonomic and functional microbial biodiversity which is supporting ecosystem functions and ensuring their stability and recovery. This is in accordance with the need to reinforce the ecological relevance of ecotoxicological studies (Schmitt-Jansen et al. 2008) in order to provide new ecological indicators and give new insight in measuring the impact of pollutants on ‘ecosystem health’ (Costanza et al. 1992).

Possibly, one of the originality of microbial ecotoxicology lies in the role of microorganisms in the ecodynamic of the pollutants, which is not strictly taken into account in ecotoxicology. Microbial contamination can occur by accidental introduction of infectious microorganisms (bacteria, yeast, mould, fungi, virus, prions, protozoa) or their

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