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Editorial: Microbial volatiles and communication

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Editorial on the Research Topic
Microbial volatiles and communication

Microorganisms release a chemically diverse range of volatile compounds that mediate interactions with other (micro)organisms and act as infochemicals in both intra- and interspecific interactions. For example, microbial volatiles can play a key role in interactions between plants and insects, plants and microbes, and humans and blood-feeding insects, as well as in human–human communication. Microbial volatiles can induce plant systemic resistance to pests and affect the interactions between plants and beneficial insects such as carnivores and pollinators. Volatiles emitted by commensal human skin bacteria can render people more attractive to blood-feeding insects, which are vectors of pathogens. Such odours emitted by skin bacteria can also be involved in the communication between humans, for example, mothers and their babies. Moreover, volatiles emitted by plant-associated microorganisms can impact plant growth and health. In this Research Topic, we present advances on the role of microbial volatiles in intra- and interspecific interactions and the new methodologies developed that help to reveal the mechanisms underlying such interactions.

When it comes to methods, Bruisson et al. developed a bioassay designed to investigate volatile-mediated interactions allowing for unidirectional exposure of a "receiver" microorganism to the volatiles of an "emitting" microorganism. Among their findings, the authors highlighted that when the "receiver" *Trichoderma simmonsii* was exposed to volatiles emitted by the fungal pathogens *Botrytis cinerea* and *Fusarium oxysporum*, two and seven volatile compounds, respectively, were no longer detected in the complex blend emitted by the receiver prior to exposure to volatiles of the fungal pathogens. In addition, there were other volatiles for which a species-specific increase in abundance was observed. Haertl et al. developed an interdisciplinary methodological platform to characterise both the skin microbiome and volatilome. Because the skin microbiome produces many of the volatiles released from the human skin, it is important to understand the relationship between these two and how the applied volatile and bacterial analysis may influence the results. For example, the co-occurrence of certain skin bacteria and volatiles released by the skin depended on the method used and was only significant for one of the four methods tested. The authors gave several suggestions on how to improve sampling techniques and, consequently, the results.

Recent studies shed light on the role of microbial volatiles as signalling molecules in microbial communities and suggest that diversity and competition may influence intra- and interspecific interactions. Lucas-Barbosa et al. investigated the impact of volatiles emitted by human skin bacteria on mosquito attraction, employing *in vitro* bacterial communities consisting of four of the most abundant species from individuals who are highly and poorly attractive to *Aedes aegypti*. Bacterial communities mimicking the species composition of highly attractive individuals were more attractive to the mosquito when grown under competitive conditions compared with non-competitive conditions. In addition, communities consisting of two or more species were also less attractive to the mosquito compared with the single-species scenario. These results suggest that diversity and interactions (for example, resource competition) in bacterial communities affect the volatile blends and, consequently, influence human attractiveness to mosquitoes. Koteska et al. reported the emission of volatiles by the Outer Membrane Vesicles (OMVs) of the marine bacterium *Dinoroseobacter shibae* and their potential role as signalling molecules in microbial communities. The aldehyde molecule (*Z*)-5-dodecenal was found to inhibit quorum sensing activity, a cell signalling mechanism, in *Pseudomonas putida* F117, a bacterial strain deficient in quorum-sensing signalling molecules engineered to produce green fluorescent protein (GFP) upon activation of quorum sensing. These results demonstrated the potential involvement of OMVs in the transport of volatiles through the cell membrane.

Finally, Masteling et al. presented their view on the yet unexplored evolutionary consequences of microbial volatiles as mediators of intra- and interspecific interactions. The authors discussed whether selection acting on microbial volatile-associated traits can lead to eco-evolutionary dynamics and what their effects on both the producing and perceiving microorganisms across varying phylogenetic distances would be. This Research Topic provides Frontiers' readers with insights into the chemical diversity and evolution of microbial volatile composition and into the different approaches used to unravel the biological and ecological functions of such volatile-mediated interactions. Collectively, these studies provide perspectives for the further exploration of microbial volatile communication.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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