Study: Unexpected microbes fighting harmful greenhouse gas

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The environment has a more formidable opponent than carbon dioxide. Another greenhouse gas, nitrous oxide, is 300 times more potent and also destroys the ozone layer each time it is released into the atmosphere through agricultural practices, sewage treatment and fossil fuel combustion.

Luckily, nature has a larger army than previously thought combating this greenhouse gas—according to a study by Frank Loeffler, University of Tennessee, Knoxville–Oak Ridge National Laboratory Governor's Chair for Microbiology, and his colleagues.

The findings are published in the Nov. 12 edition of the *Proceedings of the National Academy of Sciences*.

Scientists have long known about naturally occurring microorganisms called denitrifiers, which fight nitrous oxide by transforming it into harmless nitrogen gas. Loeffler and his team have now discovered that this ability also exists in many other groups of microorganisms, all of which consume nitrous oxide and potentially mitigate emissions.

The research team screened available microbial genomes encoding the enzyme systems that catalyze the reduction of the nitrous oxide to harmless nitrogen gas.

They discovered an unexpected broad distribution of this class of enzymes across different groups of microbes with the power to transform nitrous oxide to innocuous nitrogen gas. Within these groups, the enzymes were related yet evolutionarily distinct from those of the known denitrifiers. Microbes with this capability can be found in most, if not all, soils and sediments, indicating that a much larger microbial army contributes to nitrous oxide consumption.

"Before we did this study, there was an inconsistency in nitrous oxide emission predictions based on the known processes contributing to nitrous oxide consumption, suggesting the existence of an unaccounted nitrous oxide sink," said Loeffler. "The new findings potentially reconcile this discrepancy."

According to Loeffler, the discovery of this microbial diversity and its contributions to nitrous oxide consumption will allow the scientific community to advance its understanding of the ecological controls on global nitrous oxide emissions and to refine greenhouse gas cycle models.

"This will allow us to better describe and predict the consequences of human activities on ozone layer destruction and global warming," said Loeffler. "Our results imply that the analysis of the typical denitrifier populations provides an incomplete picture and is insufficient to account for or accurately predict the true nitrous oxide emissions."

Provided by University of Tennessee at Knoxville