A naturally occurring soil bacterium may provide a solution for 'forever chemicals'

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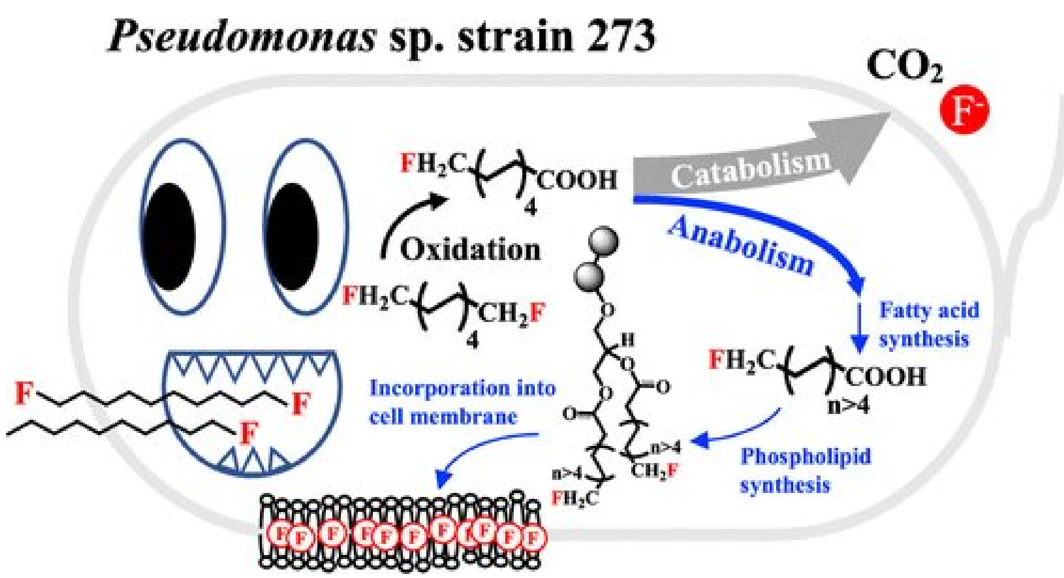

Graphical abstract. Credit: *Environmental Science & Technology* (2022). DOI: 10.1021/acs.est.2c01454

University of Tennessee, Knoxville faculty members Shawn Campagna, professor and associate department head in chemistry, and Frank Loeffler, Governor's Chair professor in microbiology, have made a discovery that could lead to new capabilities for managing environmental contamination.

Commercially used per- and polyfluoroalkyl substances (PFAS) were developed in the 1940's and made their way into a variety of common household products. Today, PFAS are used for plastic and rubber manufacturing and in food wrappers, umbrellas, firefighting foam and more.

PFAS have also been called "forever chemicals" due to their resistance to breaking down in both the environment and the human body. PFAS have been discovered lingering in rivers, Arctic sea ice, human breast milk and in the blood of 97% of Americans. Most troublesome is their potential impact on human health and PFAS have been linked to metabolic disruption, obesity, diabetes, immune suppression, and cancer.

Loeffler and Campagna's work, recently published in *Environmental Science and Technology*, explores a potential avenue for decreasing broad contamination with these chemicals. Their team found that a naturally occurring soil bacterium, Pseudomonas sp. strain 273, was capable of degrading and detoxifying 1,10-difluorodecane, a fluorinated compound that could be a model for dealing with PFAS.

Surprisingly, this bacterium was also able to use the fluorine containing byproducts to build lipid bilayers, or cellular membranes, which indicates that we don't yet know all that we should about the fate of this type of compounds in biological systems.

"This research is important since fluorinated organic chemicals are emerging contaminants, and we do not yet know how and if they enter the food web," said Campagna. "The fact that bacteria can incorporate breakdown products of these molecules into their biomass indicates that we don't fully understand the environmental impact of these contaminants."

This discovery developed from a long-standing series of collaborations between Campagna and Loeffler and leverages the capabilities of both the Center for Environmental Biotechnology and the Biological and

Small Molecule Mass Spectrometry Core.

"There is a pressing need to demonstrate that natural degradation processes for PFAS exist—that they are not forever chemicals," said Loeffler.

"The new findings emerged through collaborative efforts at the interface of disciplines, specifically environmental microbiology and analytical chemistry. My group obtained and characterized the unique microorganism, and Dr. Campagna's group had the instrumentation and expertise to perform the analytical procedures. The results are a product of teamwork and neither group individually would have succeeded."

Campagna and Loeffler hope their work can lead to further discoveries of bacteria capable of degrading the entire range of fluorinated pollutants, which could lead to removing PFAS from contaminated areas like drinking water.

More information: Yongchao Xie et al, Pseudomonas sp. Strain 273 Incorporates Organofluorine into the Lipid Bilayer during Growth with Fluorinated Alkanes, *Environmental Science & Technology* (2022). DOI: 10.1021/acs.est.2c01454

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