

Microbiome serves as sentinel for nerve gas exposure

September 14 2018

Exposure to banned nerve agents remains a major public health concern globally, especially because of the recent air-release of these agents in Syria. One main problem is the difficulty of determining whether an exposure has occurred. Now, a new study demonstrates that the mammalian microbiome can act as a "sentinel" due to its high responsiveness to exposure. The research is published on September 14 in *Applied and Environmental Microbiology*, a journal of the American Society for Microbiology.

In this study, the investigators exposed Sprague Dawley laboratory rats to the nerve gas soman, which is similar to sarin, an agent believed to have been released in Syria. Soman and sarin are organophosphates, which are used in certain pesticides and nerve gases. They block the normal breakdown of the neurotransmitter, acetylcholine, causing overstimulation of nerves, muscles, and certain glands. In large doses, these compounds interfere with the mechanism that turns off nerve transmission, causing suffocation.

The investigators examined the microbiome for changes at 72 hours post [exposure](#). "Our aim was to determine specific features of physiologic injury resulting from mild exposure to soman," since these might provide warning symptoms and identify people needing treatment, said first author Derese Getnet, Ph.D., Research Scientist, Integrative Systems Biology Program, US Army Center for Environmental Health Research, Fort Detrick, MD.

The most notable changes in the microbiome were the detection of the bacterial genera, *Facklamia*, *Enterobacter*, and *Bilophila*, and the beneficial-to-plants genus, *Rhizobium*. "It was very interesting to see *Rhizobium* grow in the presence of organophosphate since it is a known class of organism associated with bioremediation," said Dr. Getnet. *Rhizobium* is normally not associated with intestines, but the presence of organophosphate might have given it a brief advantage over competing microbes.

"These signatures of exposure are detectable for at least 72 hours following exposure, and they persist not only in symptomatic animals, but also in asymptomatic animals," said Dr. Getnet. "It should be possible to detect these changes before any symptoms develop, or if asymptomatic exposure has occurred." Dr. Getnet also noted that an advantage of this form of sampling is that it's non-invasive, and that sites and subjects can be screened on a routine basis, absent specific knowledge of exposure.

This is important because during nerve agent attacks, it is very difficult to determine the boundaries of the affected area, as well as who has been exposed. Additionally, the onset of symptoms is unpredictable, causing estimates of exposure based on symptoms to be inaccurate.

"The motivation behind this research is to identify novel signatures for [nerve agents](#) and organophosphate exposures that can quickly be adapted into the clinical pathology workflow of urine chemistry and microbiology, without the need to develop novel technology and clinical standards," said Dr. Getnet. He noted that this work is "proof of concept" only, and more research will be necessary to determine the sensitivity of the sampling to each toxicant, as well as the signals for all of the different organophosphate pesticides and nerve agents.

To this end, there will be no need to develop novel platforms. Rather,

existing technologies will simply need to be refined, said Dr. Getnet.

These developments could be very important for protecting civilians as well as the armed forces from nerve agents, or organophosphate toxicants, said Dr. Getnet. The work could also enable hospitals to determine whether a person has been exposed not only to [nerve](#) agents, but to [organophosphate](#) pesticides and to fire retardants, both of which can also be quite harmful.

Provided by American Society for Microbiology

Citation: Microbiome serves as sentinel for nerve gas exposure (2018, September 14) retrieved 18 April 2024 from

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