Breath analysis reliably indicates presence, level of infection in mice, study finds

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Breath analysis may prove to be an accurate, noninvasive way to quickly determine the severity of bacterial and other infections, according to a UC Irvine study appearing online today in the open-access journal *PLOS ONE*.

Employing a chemical analysis method developed for air pollution testing, UC Irvine microbiologists and chemists were able to correlate inflammation levels in laboratory mice to the amount of naturally produced carbon monoxide and other gases in breath samples.

The findings point to human applications of this technology in emergency rooms and intensive care units, potentially augmenting or replacing blood tests.

"Breath analysis has been showing promise as a diagnostic tool in a number of chronic diseases," said Dr. Alan Barbour, professor of microbiology & molecular genetics and medicine. "This study provides the first evidence … that it can be used for rapid clinical assessment of infections, which can lead to prompt institution of effective treatments."

Barbour collaborated with UC Irvine chemist Donald Blake, utilizing a gas analysis method devised for the Rowland-Blake lab's atmospheric chemistry research, which measures the level of trace gases that contribute to local and regional air pollution. It's one of the few research groups in the world recognized for its ability to gauge precisely at the parts-per-trillion level. Previous breath sampling work by the Rowland-

Blake lab has involved diabetes, cystic fibrosis and kidney failure.

Barbour believed that breath analysis could additionally be used on infections, which elicit strong inflammatory responses in the body. Several compounds, or "biomarkers," are by-products of these responses. They can be identified in blood but also detected in exhaled breath.

Studying mice with bacterial blood infections, the researchers found that increases in the severity of infection elicited significantly higher amounts of carbon monoxide in relation to carbon dioxide in breath samples, making carbon monoxide a reliable biomarker for the presence and intensity of infection. Importantly, the carbon monoxide returned to normal levels soon after an antibiotic was given.

"Using a breath analysis method like this could help physicians in the emergency room and ICU make critical decisions about serious infections more quickly than if they had to wait for blood tests to come back from the lab," Barbour said.

He and Blake will next expand their research to human breath samples. Their diagnostic method is currently under patent review.

More information: dx.plos.org/10.1371/journal.pone.0069802

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