THE BALTIMORE SUN

New protein reverses carbon monoxide poisoning

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PUBLISHED: October 7, 2025 at 5:33 PM EDT

Algerina Perna, Baltimore Sun

Carbon monoxide detectors like these can save a life. Credit: (Staff photo)

A new engineered molecule shows promise as an antidote for carbon monoxide poisoning with fewer side effects than other remedies currently being tested, according to research from the University of Maryland School of Medicine.

Carbon monoxide (CO) poisoning sends about 50,000 Americans to the emergency room each year. In 2022, the CDC reported that 1,244 people in the US died from carbon monoxide poisoning, including 624 accidental deaths and 8 Maryland residents.

“Carbon monoxide is the most common poison in America and in the world, and there’s no antidote for it,” said Dr. Mark Gladwin, dean of the School of Medicine and principal investigator of the lab which produced the study. “When people die in house fires, it’s usually due to carbon monoxide poisoning,” Gladwin said.

It can also come from operating any kind of combustion in an enclosed space, including a grill, a diesel generator, or an automobile.

The researchers published their findings about their engineered molecule, RcoM-HBD-CCC, in the Proceedings of the National Academy of Sciences in August.

This molecular treatment could equip emergency responders with a remedy on the scene, said Dr. Jason Rose, division chief of Pulmonary, Critical Care & Sleep Medicine and one of the study’s authors.

“This molecule could be a game-changer because it can directly and rapidly remove carbon monoxide from the body with such a low risk of off-target side effects,” Rose said.

His lab team has been chasing a molecular treatment for CO poisoning for more than a decade, Rose said, looking at the role of different molecules including nitric oxide to remove carbon monoxide from red blood cells.

“The ‘aha!’ moment was when we discovered that there were these soil bacteria that actually use CO for energy instead of oxygen,” Rose said. “They’ve evolved this protein to detect very low levels of CO in their environment.”

His team genetically engineered bacteria and yeast to produce the protein. Their next step will be designing animal and human trials to verify the treatment’s safety.

Carbon monoxide poisoning is particularly difficult to treat because of how tightly CO binds to the hemoglobin in red blood cells. Hemoglobin is the compound that carries oxygen throughout the body, according to the Maryland Department of Health. Carbon monoxide prevents the blood from absorbing oxygen, and it takes a long time — up to 27 hours, to clear from the body without care.

Treatment options include administering pure oxygen from a mask, or inside a pressurized chamber if available, Dr. Gladwin said. This treatment still takes more than an hour,

depending on how quickly the patient gets help. Even if the patient recovers, they might suffer lasting cardiac and neurological injuries.

Symptoms of CO poisoning according to the Maryland Department of Health

- **Headache**
- **Drowsiness or dizziness**
- **Nausea and vomiting**
- **Weakness, fatigue, and confusion**
- **Chest pain**
- **High levels of CO inhalation can cause loss of consciousness and death, especially in people who are already sleeping or intoxicated.**

“It’s a tough one,” Gladwin said, “because it’s colorless, odorless, tasteless. I encourage everyone to have carbon monoxide detectors in their home, on every floor of their home.”