Chemists moving forward with tool to detect hydrogen sulfide

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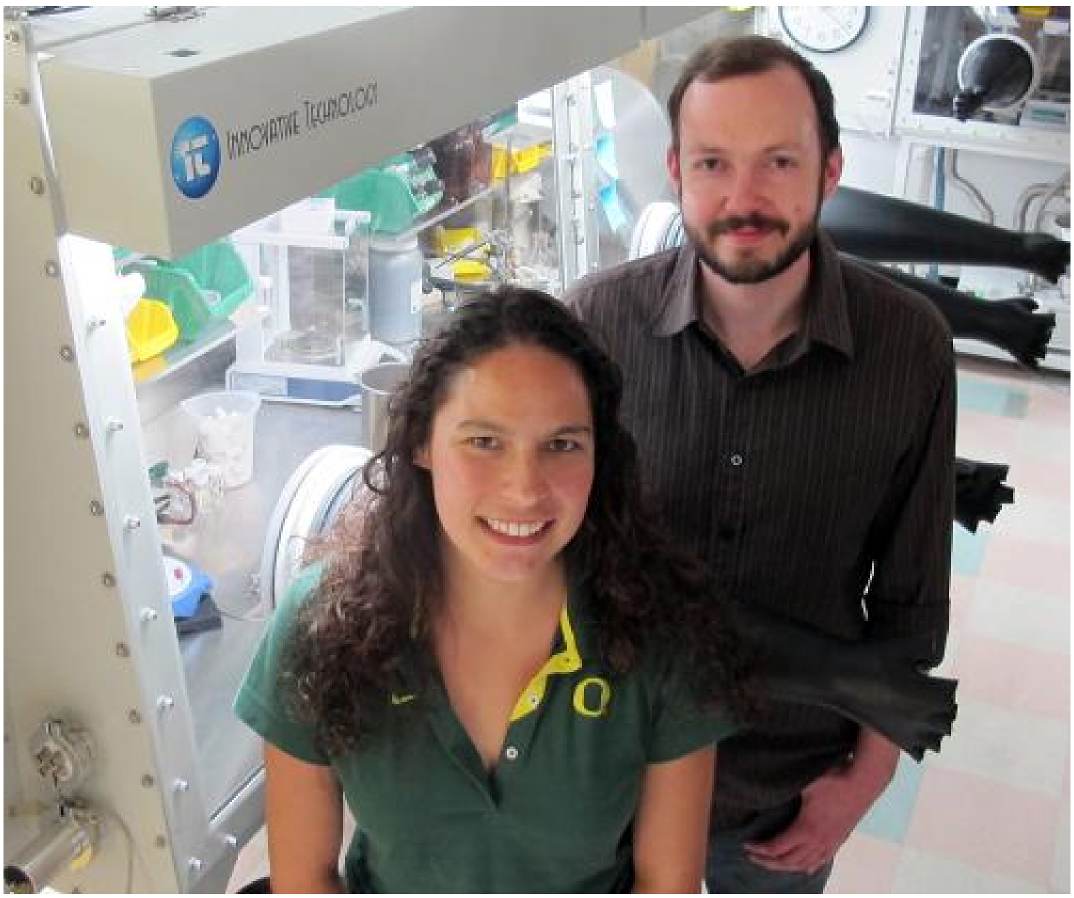

Doctoral student Leticia A. Montoya and Michael Pluth, professor of chemistry, of the University of Oregon have developed a sensitive probe that detects H2S in biological samples and in the environment. Credit: University of Oregon

University of Oregon chemists have developed a selective probe that detects hydrogen sulfide (H2S) levels as low as 190 nanomolar (10 parts per billion) in biological samples. They say the technique could serve as a new tool for basic biological research and as an enhanced detection system for H2S in suspected bacterially contaminated water sources.

Hydrogen sulfide, a colorless gas, has long been known for its dangerous toxicity—and its telltale smell of rotten eggs—in the environment, but in the last decade the gas has been found to be produced in mammals, including humans, with seemingly important roles in molecular signaling and cardiac health. Detection methods for biological systems are emerging from many laboratories as scientists seek to understand the roles of H2S in general health and different diseases.

Reporting in the *Journal of Organic Chemistry*—online in advance of regular print publication—researchers in the UO lab of Michael D. Pluth, professor of chemistry, describe the development of a colorimetric probe that relies on nucleophilic aromatic substitution to react selectively with H2S to produce a characteristic purple product, allowing for precise H2S measurement.

"This paper describes a new way to selectively detect H2S," said Pluth, who has been pursuing detection methods for the gas under a National Institutes of Health "Pathway to Independence" grant. That early career award began while he was a postdoctoral researcher at the Massachusetts Institute of Technology. "This technique allows you to use instruments to quantify how much H2S has been produced in a sample, and the distinctive color change allows for naked-eye detection."

In biological samples, he said, the approach allows for a precise measurement. In the environment, he added, the technique could be used to determine if potentially harmful H2S-producing bacteria are a contaminant in water sources through the creation of testing kits to detect the gas when levels are above a defined threshold.

The key to the technique, said the paper's lead author, doctoral student Leticia A. Montoya, is the reaction process in which the probe reacts with H2S to produce a distinctly identifiable purple compound. "This method allows you look selectively at hydrogen sulfide versus any other nucleophiles or biological thiols in a system," Montoya said. "It allows you to more easily visualize where H2S is present."

The chemical reaction produced in the experiments, Pluth said, also holds the potential to be applied in a variety of materials, on surfaces and films, with appropriate modifications. The UO has applied for a provisional patent to cover the technology.

The study is the second in which Pluth's lab has reported potential detection probes for H2S. Last year, in the journal Chemical Communications, Montoya and Pluth described their development of two bright fluorescent probes that sort out H2S from among cysteine, glutathione and other reactive sulfur, nitrogen and oxygen species in living cells.

"We're really interested in making sharper tools," Pluth said. "We have the basic science worked out, and now we want to move forward to fine-tune our tools so that we can better use them to answer important scientific questions."

"University of Oregon researchers are helping to foster a more sustainable future by developing powerful new tools and entrepreneurial technologies," said Kimberly Andrews Espy, vice president for research and innovation and dean of the UO graduate school. "This important research from Dr. Pluth's lab may someday alert us to environmental contaminants and could also impact basic science and human health."

Provided by University of Oregon