standard blue absorber, achieving an efficiency of 20.3% in a pure perovskite tandem. Although not yet as good as perovskite-silicon tandems, the perovskite components in the cells are still rapidly improving, whereas silicon has flatlined.

For all their gains in efficiency, perovskites have faced lingering problems. Water vapor, high temperatures, or even prolonged sun exposure can dissolve or degrade perovskites within hours. But at the MRS meeting, McGehee reported exceptional stability for new perovskite recipes that replace an organic component called methylammonium with formamidinium or the element cesium. When encapsulated to protect them from moisture, these cells showed no sign of degradation for 6 weeks, even when exposed to temperatures of 85°C and a relative humidity of 85%, a standard test of durability. "Panels that pass it usually will not fail due to heat and humidity over 25 years outside," McGehee says.

Others are reporting improvements in manufacturing commercial-sized cells rather than the small, bespoke crystals used for setting records. Christopher Case, the chief technology officer for Oxford Photovoltaics (Oxford PV) in the United Kingdom, a perovskite solar cell company launched by Snaith, says the company has scaled up the postage stamp–sized research cells to ones that are 10 centimeters square and that have passed industry durability standards. Last month, the company acquired a former photovoltaic pilot facility in Germany. It is now gearing up to produce perovskite cells atop full-sized commercial silicon wafers, 15 centimeters on a side, Case says. Oxford PV also recently announced that they raised an additional £26 million ($33 million) over the last 18 months from investors, and Case says the company has inked partnerships with several of the top 10 silicon solar cell producers to investigate adding perovskites to their cells. If all goes well, he says, the first pilot products could appear in 2018.

That leaves safety as the major outstanding roadblock to commercialization. The most efficient perovskites contain a highly soluble form of lead, a dangerous neurotoxin that could leach into homes, soil, or groundwater if the cells degrade. Babayigit says there are potential solutions, such as encapsulating the perovskite in protective shells or adding sulfides around the cell, which would bind and quarantine any lead that managed to escape. For now, she says, "it's a heavily underresearched field that needs attention." Given how quickly perovskites are moving to market, it's a safe bet that someone will soon take on the project. ■

BIOMEDICINE

Carbon monoxide, the silent killer, may have met its match

Repurposed molecule saves rodents from gas poisoning

By **Wudan Yan**

On 26 January, Ling Wang and Qinzi Xu, two biomedical scientists at the University of Pittsburgh in Pennsylvania, placed a mouse under a chemical hood, anesthetized it, and hooked it up to monitors. Wang closed the hood and Xu turned on a switch to deliver 3% carbon monoxide (CO)—a concentration so high that it would kill most humans almost immediately—for 4.5 minutes. The mouse's blood pressure dropped precipitously and its heart rate turned irregular. Then, through an intravenous tube, they delivered a molecule their lab had developed. Moments later, the animal's blood pressure began to rise and it recovered. This was a first: There are no known antidotes for CO poisoning.

Given off by engines, heaters, and fireplaces, the tasteless, odorless gas sends more than 50,000 Americans to the emergency room—and kills approximately 500—every year. CO poisons in at least two ways. First, it binds tightly to the hemoglobin in blood and prevents it from delivering oxygen throughout the body. Second, it inhibits the process of respiration in mitochondria, cells' powerhouses. About the best physicians can now offer in cases of poisoning is a treatment developed more than 50 years ago: high-pressure oxygen.

"People have attempted some biochemical tricks to free carbon monoxide from hemoglobin, but they don't really work. That's why we literally have a therapy that's as old as oxygen," says Lance Becker, a physician at the Hofstra Northwell School of Medicine in Manhasset, New York. "So the idea of finding something that might work better, faster, and stronger is very appealing."

That something, described in this week's issue of *Science Translational Medicine*, is neuroglobin—a protein typically found in the brain and retina that protects cells from injury by binding oxygen and nitric oxide—repurposed into a CO scavenger. The Pittsburgh research team, led by critical care physician Mark Gladwin, was originally studying its function when they noticed that isolated neuroglobin molecules almost always had CO, a natural byproduct of hemoglobin breakdown, bound to them. "I thought this was bad news at the time, because we needed to get the CO off the neuroglobin in an extra experimental step," Gladwin said. But when a colleague asked in 2012 whether there was any antidote for CO poisoning, he realized that his lab might already have an answer.

"This agent is phenomenal: It can rip CO right off the hemoglobin ... [It] could be life-saving."

Lindell Weaver, Intermountain Healthcare

In the mouse study, the group engineered a mutated version of neuroglobin that binds CO 500 times more tightly than it binds hemoglobin. The CO-laden molecules are excreted through the kidneys. When given within 5 minutes of a lethal dose of CO, the neuroglobin saved 87% of mice, the group reports. "This agent is phenomenal: It can rip carbon monoxide right off the hemoglobin," says Lindell Weaver, a doctor who treats patients with high-pressure oxygen at Intermountain Healthcare in Salt Lake City.

Weaver notes, however, that CO poisoning also activates a series of immunological pathways that cause lingering damage to the nervous and cardiovascular systems. "The long-term effects of carbon monoxide are complicated, so just removing [it] might not be enough," he says. "But this agent could be life-saving if it's administered immediately."

Gladwin's team now plans to further explore the efficacy and safety of the neuroglobin in rats, larger mammals, and, eventually, patients. One challenge will be making the neuroglobin scavenger in the amounts needed for use in the field and clinic. The U.S. Food and Drug Administration, Gladwin says, has already promised an expedited review of the treatment given that CO poisoning is a "serious unmet need." ■

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Wudan Yan (December 8, 2016)

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