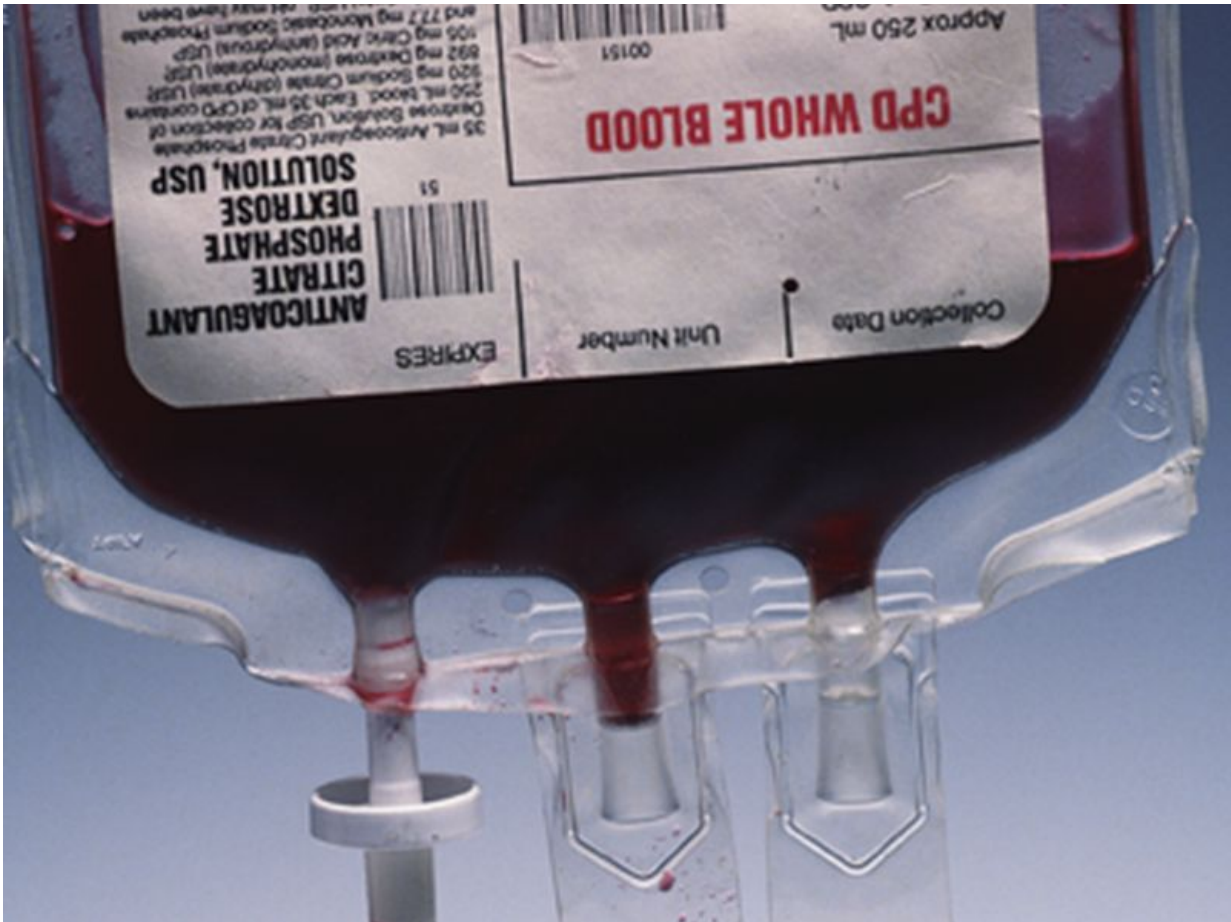


Another step closer to artificial blood

December 5 2016, by Dennis Thompson, Healthday Reporter



(HealthDay)—Artificial blood stored as a powder could one day revolutionize emergency medicine and provide trauma victims a better chance of survival.

Researchers have created an artificial [red blood cell](#) that effectively picks up [oxygen](#) in the lungs and delivers it to tissues throughout the body.

This [artificial blood](#) can be freeze-dried, making it easier for combat medics and paramedics to keep on hand for emergencies, said senior researcher Dr. Allan Doctor. He is a critical care specialist at Washington University School of Medicine in St. Louis.

"It's a dried powder that looks like paprika, basically," Doctor said. "It can be stored in an IV plastic bag that a medic would carry, either in their ambulance or in a backpack, for a year or more. When they need to use it, they spike the bag with sterile water, mix it, and it's ready to inject right then and there."

The artificial blood cell, which is about one-fiftieth the size of a normal red blood cell, is made from purified human hemoglobin proteins that have been coated with a synthetic polymer, Doctor said. Hemoglobin is the component inside red blood cells that carries oxygen throughout the body.

It's estimated that as many as 70 percent of battlefield fatalities are due to shock caused by blood loss rather than life-threatening injuries to vital organs, Doctor said. Additionally, about 20,000 trauma deaths in the United States occur each year due to blood loss prior to arriving at a treatment center.

The hunt for an artificial blood substitute has been underway for more than 80 years, but the closest prior attempts have failed in two major ways, Doctor said.

Earlier versions could capture oxygen in the lungs, but then would not effectively release the oxygen after traveling out to tissues and organs, he

said.

There also was an unintended reaction between "naked" hemoglobin and nitric oxide, a substance released by the lining of [blood vessels](#) that allows the vessels to relax and open up, Doctor noted.

"The hemoglobin consumes that molecule and causes a constriction of the blood vessels," Doctor said. "When they tried to put naked hemoglobin into the bloodstream, it caused heart attacks and strokes."

The synthetic polymer coating of the latest artificial blood cell appears to solve both these problems, Doctor explained. The coating was developed by the study's lead researcher, Dipanjan Pan, an assistant professor of bioengineering with the University of Illinois at Urbana-Champaign.

The surface chemistry of the polymer reacts to the pH level of blood as it travels through the body, Doctor said. It captures oxygen when blood pH is high, and releases oxygen when blood pH is low.

"Blood pH is high in the lungs, is low in tissue, and is even lower in tissue that doesn't have enough oxygen," Doctor said. "By linking oxygen affinity to blood pH, we imitate the behavior of a normal red cell."

The polymer coating also keeps the hemoglobin from reacting with nitric oxide in the bloodstream, thus preventing dangerous constriction of the blood vessels, he added.

There's also one more benefit—because the [polymer coating](#) is "immune silent," the artificial blood can be used in anyone regardless of blood type, Doctor said.

Lab tests involving mice and rats have proven that the artificial red blood

cells can effectively deliver oxygen to needy tissues, the researchers reported.

"We replaced 70 percent of the mouse's blood volume with the blood substitute," Doctor said. "Those mice were indistinguishable from those who received a transfusion from another mouse."

Besides emergency settings, the artificial blood also could be used to help keep donated organs alive on route to a recipient, and supplement a hospital's regular blood supplies during complex surgeries such as open-heart bypass, he suggested.

However, the artificial red blood cells will never totally replace the real thing, Doctor said.

For one thing, they can't remain in the bloodstream anywhere near as long as regular red blood cells.

"A normal red blood cell circulates about 120 days. This cell right now, we project circulation for about a third of a day to half a day," Doctor said. "We may be able to manipulate that and get it up to a couple of days, but I seriously doubt we'll be able to get to the circulation time of a normal red blood cell."

The artificial cell also is designed solely to deliver oxygen, and leaves out a number of other functions that red blood cells provide.

Those other functions include antioxidant protection of tissues, regulation of blood flow, assistance in immune response, and aid in forming blood clots and scabs, said Doctor and Dr. Alan Mast, a senior investigator with the BloodCenter of Wisconsin's Blood Research Institute.

"I think of these more as artificial oxygen carriers, because they're not the same as red blood cells," said Mast, a past president of the American Society of Hematology. He was not involved with the new study. "[Red blood cells](#) can do many other physiologic things."

Nonetheless, Mast said the development of these artificial cells is "exciting."

"This could buy time for injured soldiers until they can get them to a hospital," Mast said. "The product also could be useful in rural areas or areas where traumatic events occur and [blood](#) products aren't readily available."

Don't expect it to be available anytime soon though, Doctor warned. It still needs to be tested in rabbits and monkeys, before proceeding to human testing. And studies in animals often fail to produce similar results in humans.

"It's quite a long road, possibly as long as 10 years before we have definitive answers whether this will work in people," Doctor said.

Findings from the study are scheduled to be presented Saturday at the American Society of Hematology's annual meeting, in San Diego. Study results presented at meetings are generally viewed as preliminary until they've been published in a peer-reviewed journal.

More information: For more on red blood cells, visit the [American Red Cross](#).

Copyright © 2016 [HealthDay](#). All rights reserved.

Citation: Another step closer to artificial blood (2016, December 5) retrieved 2 May 2024 from

<https://medicalxpress.com/news/2016-12-closer-artificial-blood.html>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.