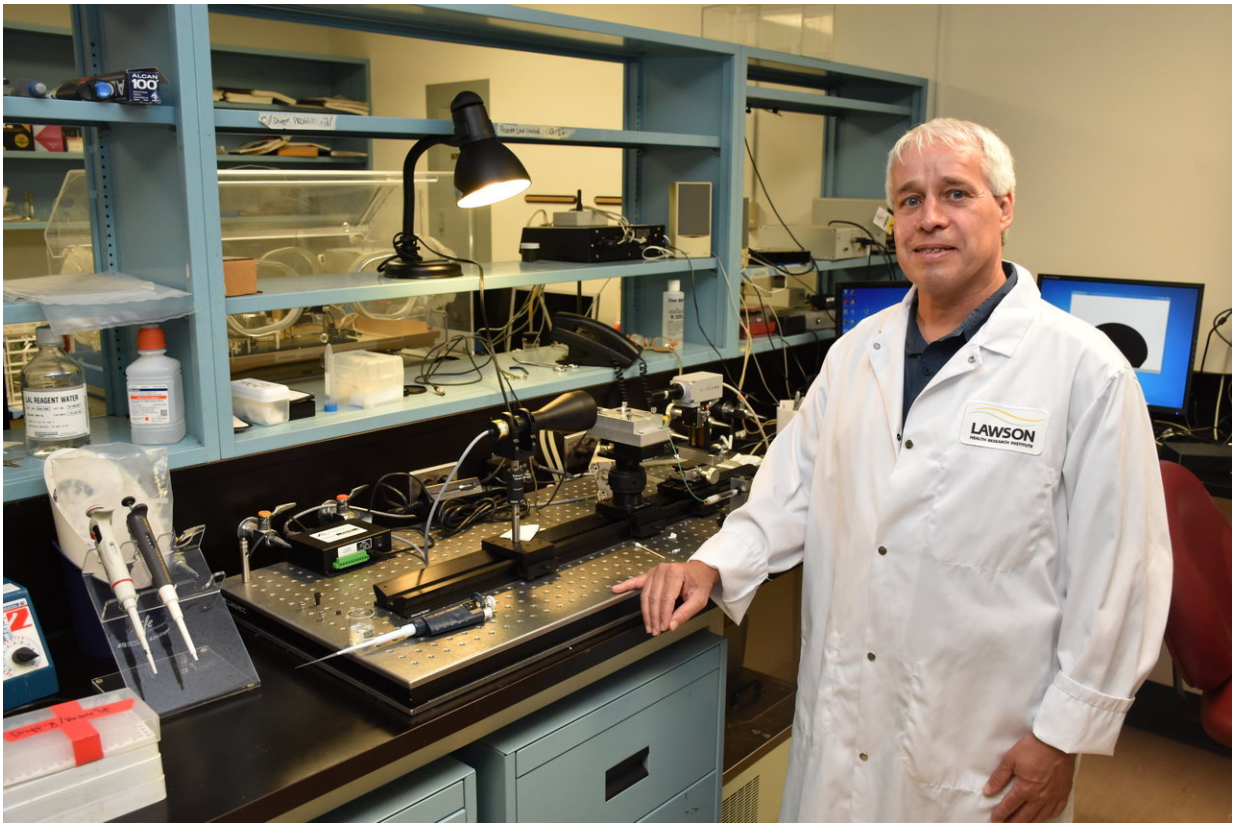
Synthetic surfactant could ease breathing for patients with lung disease and injury

July 9 2018



Dr. Ruud Veldhuizen, scientist at Lawson Health Research Institute and co-investigator on the study. Credit: Lawson Health Research Institute

Human lungs are coated with a substance called surfactant which allows us to breathe easily. When lung surfactant is missing or depleted, which

can happen with premature birth or lung injury, breathing becomes difficult. In a collaborative study between Lawson Health Research Institute and Stanford University, scientists have developed and tested a new synthetic surfactant that could lead to improved treatments for lung disease and injury.

Lung surfactant is made up of lipids and proteins which help lower tension on the lung's surface, reducing the amount of effort needed to take a breath. The proteins, called surfactant-associated proteins, are very difficult to create in a laboratory and so the surfactant most commonly used in medicine is obtained from animal lungs.

London, Ontario has a rich legacy in surfactant research and innovation. Dr. Fred Possmayer, a scientist at Lawson and Western University, pioneered the technique used to purify and sterilize lung surfactant extracted from cows. Called bovine lipid extract surfactant (BLES), the therapeutic is made in London, Ontario and used by nearly all neonatal intensive care units in Canada to treat premature babies with respiratory distress.

"When we look at treating adults, surfactant therapy is more difficult. For example, their lungs are 20 times bigger than those of babies and so we need much higher doses of surfactant," explains Dr. Ruud Veldhuizen, a scientist at Lawson and an associate professor at Western University's Schulich School of Medicine & Dentistry. "We therefore need to find novel approaches to surfactant therapy for adult patients."

In this collaborative study, the research team took a new approach to creating synthetic surfactant. Rather than trying to recreate surfactant-associated proteins in the lab, scientists at Stanford created protein mimics. Pioneered by Dr. Annelise Barron, associate professor at Stanford, these protein mimics look like surfactant-associated proteins and have similar properties but are easier to create and more stable. As a

result, the team was able to create a new synthetic surfactant.

Collaborating with the Stanford team, Dr. Veldhuizen evaluated the synthetic surfactant in animal models in his research lab at St. Joseph's Health Care London. The study showed that, unlike other synthetic surfactants currently on the market, the new surfactant equaled or outperformed the animal-derived surfactant in every outcome. This included outperforming animal-derived surfactant in oxygenating blood, which is the lungs' main purpose.

"The unique ability of the Veldhuizen lab to perform these rigorous and sophisticated studies was a critical aspect of the success of this project," says Dr. Barron.

"These are very promising results," says Dr. Veldhuizen. "For the first time, a synthetic surfactant has been developed which appears to be just as effective, if not more so, as that taken from the lungs of animals."

The team estimates that the synthetic surfactant could be produced at as low as one quarter of the cost of the animal-derived surfactant. With a lower cost the synthetic surfactant could be tested with more lung diseases and injuries in adults and made available in more developing countries.

The team hopes to continue their research with further testing of the synthetic surfactant, including its long term effects. The team also hopes to test its ability to be customized for specific diseases. "Since it is made in the lab, we could combine the surfactant with other drugs like antibacterial agents and deliver it to specific areas of the lung, such as those where an infection is located," explains Dr. Veldhuizen.

One disease the scientists would like to further study is acute respiratory distress syndrome (ARDS). ARDS is characterized by a low amount of

oxygen in the blood due to difficulty breathing. While current surfactants have been tested with ARDS patients, they have not been effective. Dr. Veldhuizen wants to combine this new synthetic surfactant with anti-inflammatory agents and antibacterial agents to test whether patient outcomes are improved.

The study, "Effective in vivo treatment of acute lung injury with helical, amphipathic peptoid mimics of pulmonary surfactant proteins," is published in *Scientific Reports*.

More information: Ann M. Czyzewski et al, Effective in vivo treatment of acute lung injury with helical, amphipathic peptoid mimics of pulmonary surfactant proteins, *Scientific Reports* (2018). DOI: 10.1038/s41598-018-25009-3

Provided by Lawson Health Research Institute