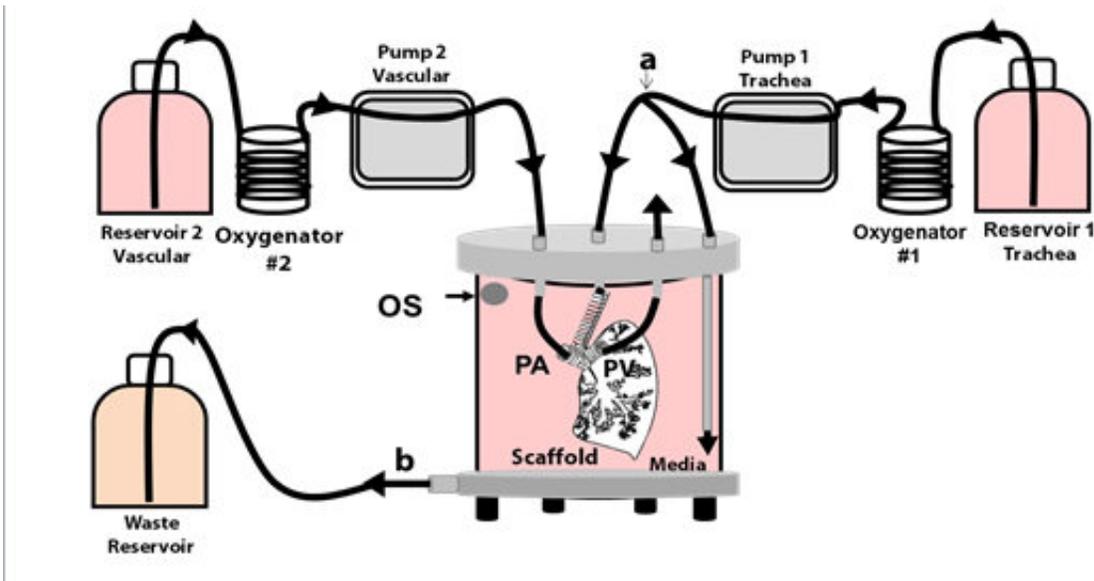


Researchers successfully transplant bioengineered lung

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The bioengineered lungs were grown and tested in a bioreactor chamber. Credit: J. Nichols et al., *Science Translational Medicine* (2018)

A research team at the University of Texas Medical Branch have bioengineered lungs and transplanted them into adult pigs with no medical complication.

In 2014, Joan Nichols and Joaquin Cortiella from The University of Texas Medical Branch at Galveston were the first research team to successfully bioengineer human lungs in a lab. In a paper now available in *Science Translational Medicine*, they provide details of how their work

has progressed from 2014 to the point no complications have occurred in the pigs as part of standard preclinical testing.

"The number of people who have developed severe lung injuries has increased worldwide, while the number of available transplantable organs have decreased," said Cortiella, professor of pediatric anesthesia. "Our ultimate goal is to eventually provide new options for the many people awaiting a transplant," said Nichols, professor of internal medicine and associate director of the Galveston National Laboratory at UTMB.

To produce a bioengineered lung, a support scaffold is needed that meets the structural needs of a lung. A support scaffold was created using a lung from an unrelated animal that was treated using a special mixture of sugar and detergent to eliminate all cells and blood in the lung, leaving only the scaffolding proteins or skeleton of the lung behind. This is a lung-shaped scaffold made totally from lung proteins.

The cells used to produce each bioengineered lung came from a single lung removed from each of the study [animals](#). This was the source of the cells used to produce a tissue-matched bioengineered lung for each animal in the study. The lung scaffold was placed into a tank filled with a carefully blended cocktail of nutrients and the animals' own cells were added to the scaffold following a carefully designed protocol or recipe. The bioengineered lungs were grown in a bioreactor for 30 days prior to transplantation. Animal recipients were survived for 10 hours, two weeks, one month and two months after transplantation, allowing the research team to examine development of the [lung tissue](#) following transplantation and how the bioengineered lung would integrate with the body.

All of the pigs that received a bioengineered lung stayed healthy. As early as two weeks post-transplant, the bioengineered lung had

established the strong network of blood vessels needed for the lung to survive.

"We saw no signs of pulmonary edema, which is usually a sign of the vasculature not being mature enough," said Nichols and Cortiella. "The bioengineered lungs continued to develop post-transplant without any infusions of growth factors, the body provided all of the building blocks that the new lungs needed."

Nichols said that the focus of the study was to learn how well the bioengineered lung adapted and continued to mature within a large, living body. They didn't evaluate how much the bioengineered lung provided oxygenation to the animal.



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"We do know that the animals had 100 percent oxygen saturation, as they had one normal functioning lung," said Cortiella. "Even after two months, the bioengineered lung was not yet mature enough for us to stop the animal from breathing on the normal lung and switch to just the bioengineered [lung](#)."

For this reason, future studies will look at long-term survival and maturation of the tissues as well as gas exchange capability.

The researchers said that with enough funding, they could grow lungs to transplant into people in compassionate use circumstances within five to 10 years.

"It has taken a lot of heart and 15 years of research to get us this far, our team has done something incredible with a ridiculously small budget and an amazingly dedicated group of people," Nichols and Cortiella said.

More information: J.E. Nichols et al., "Production and transplantation of bioengineered lung into a large-animal model," *Science Translational Medicine* (2018). [stm.sciencemag.org/lookup/doi/ ... scitranslmed.aao3926](https://stm.sciencemag.org/lookup/doi/10.1126/scitranslmed.aao3926)

Provided by University of Texas Medical Branch at Galveston

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