

Animals Set Survival Record Inside Artificial Womb

Fetal lambs lived for weeks in a fluid-filled bag. Tests to help premature babies could begin in three years.

[Emily Mullin](#)



A fetal lamb kept alive inside an artificial womb.

Philadelphia doctors have kept fetal lambs alive in a uterus-like plastic sack for weeks, a technological leap toward caring for premature infants that also raises questions over how early babies might be considered viable outside the womb.

The device, eyed as an improvement over incubators, kept fetal animals alive using a sterile, temperature-controlled plastic bag filled with amniotic fluid.

Physicians at the Children's Hospital of Philadelphia placed fetal lambs into the transparent bags and connected their umbilical cords to a machine that oxygenated their blood. The lambs own hearts provided the pumping power.

Eight lambs survived for as long as four weeks inside the devices. The gestational age of the animals was equivalent to a human fetus of 22 or 23 weeks, about the earliest a human baby can be born and expected to survive outside the womb. A full-term baby is born at 40 weeks.

The animals, which were able to move, open their eyes, and swallow normally, were “born” when researchers removed them from the sacs.

Tests showed they had developed normally and their lung function “essentially caught up to that of a mature infant,” says Emily Partridge, a research fellow at Children's Hospital of Philadelphia, whose description of the device was published today in [*Nature Communications*](#).

The work raises questions about whether artificial wombs could be used to extend the limits of fetal viability—that is, the ability of a fetus to survive outside its mother. In the U.S., 43 states have laws that ban abortions once a fetus is considered viable.

In a conference call with reporters, Alan Flake, director of the Philadelphia hospital's Children's Institute for Surgical Science, said the machinery would not be capable of incubating a child for a full nine months.

As yet, Flake says, no technology can replace the earliest stages of development. “There are likely developmental requirements that we cannot replicate earlier in gestation, so we could create developmental abnormalities,” he says. “We have no interest in creating more survivors with impaired quality of life. That is what we are trying to prevent.”

Flake says he would be “very concerned” if doctors wanted to use this

device to try to rescue infants born even earlier than 22 weeks.

About one in 10 births in the U.S. are premature, or at least three weeks before a baby's due date. Of those, around 30,000 each year are critically preterm, or younger than 26 weeks. Babies born that early risk lung problems as well as delays in physical development and learning.

Currently, premature babies are placed inside an incubator that warms them and protects them from germs. Partridge says placing babies inside the new device, which imitates a woman's uterus, could lower the risk of death or long-lasting problems by allowing babies to finish developing.

Researchers have been working on artificial wombs—or “ectogenesis”—for years. In 1996, Yoshinori Kuwabara of Japan's Juntendo University [successfully nurtured fetal goats](#) in plastic chambers filled with amniotic-like fluid. But past efforts often harmed animals because they relied on mechanical pumps to circulate blood.

Flake says his team has been in discussions with the U.S. Food and Drug Administration and thinks the device could be tested in a neonatal ward within three to five years.

The authors plan to redesign the fluid-filled plastic enclosure so that it looks more like a traditional incubator and doesn't alarm parents. “I don't want this to be visualized as fetuses hanging on the wall in bags. That's not the way this human device will look or work,” Flake says. The final system will be “parent-friendly,” he says.