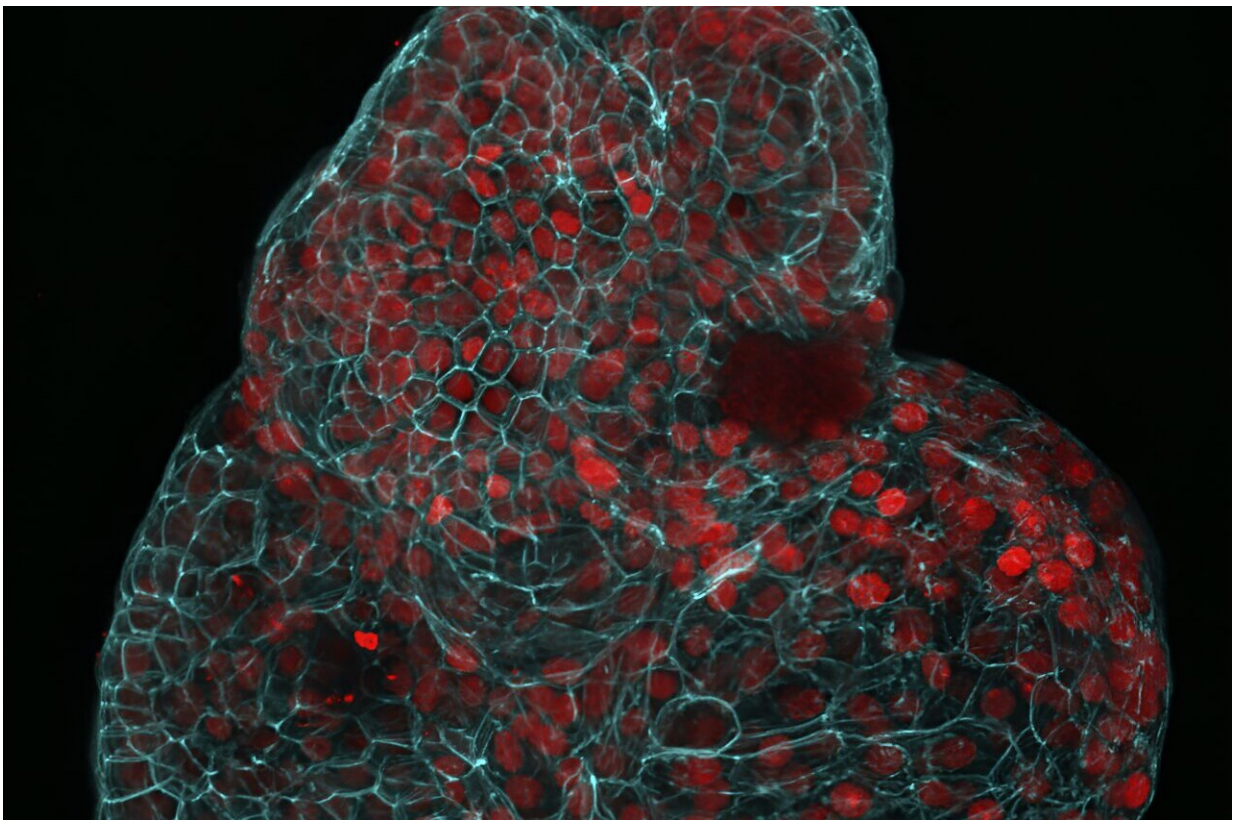
Scientists have used cells from fluid drawn during pregnancy to grow mini lungs and other organs

March 4 2024, by Laura Ungar



This microscope image provided by researchers in March 2024 shows a lung organoid created from cells collected from amniotic fluid. In a study published Monday, March 4, 2024, in the journal *Nature Medicine*, scientists in the United Kingdom described how they have made mini-organs from cells floating in amniotic fluid – an advance they believe could open up new areas of prenatal medicine. Credit: Giuseppe Calà, Paolo De Coppi, Mattia Gerli via AP

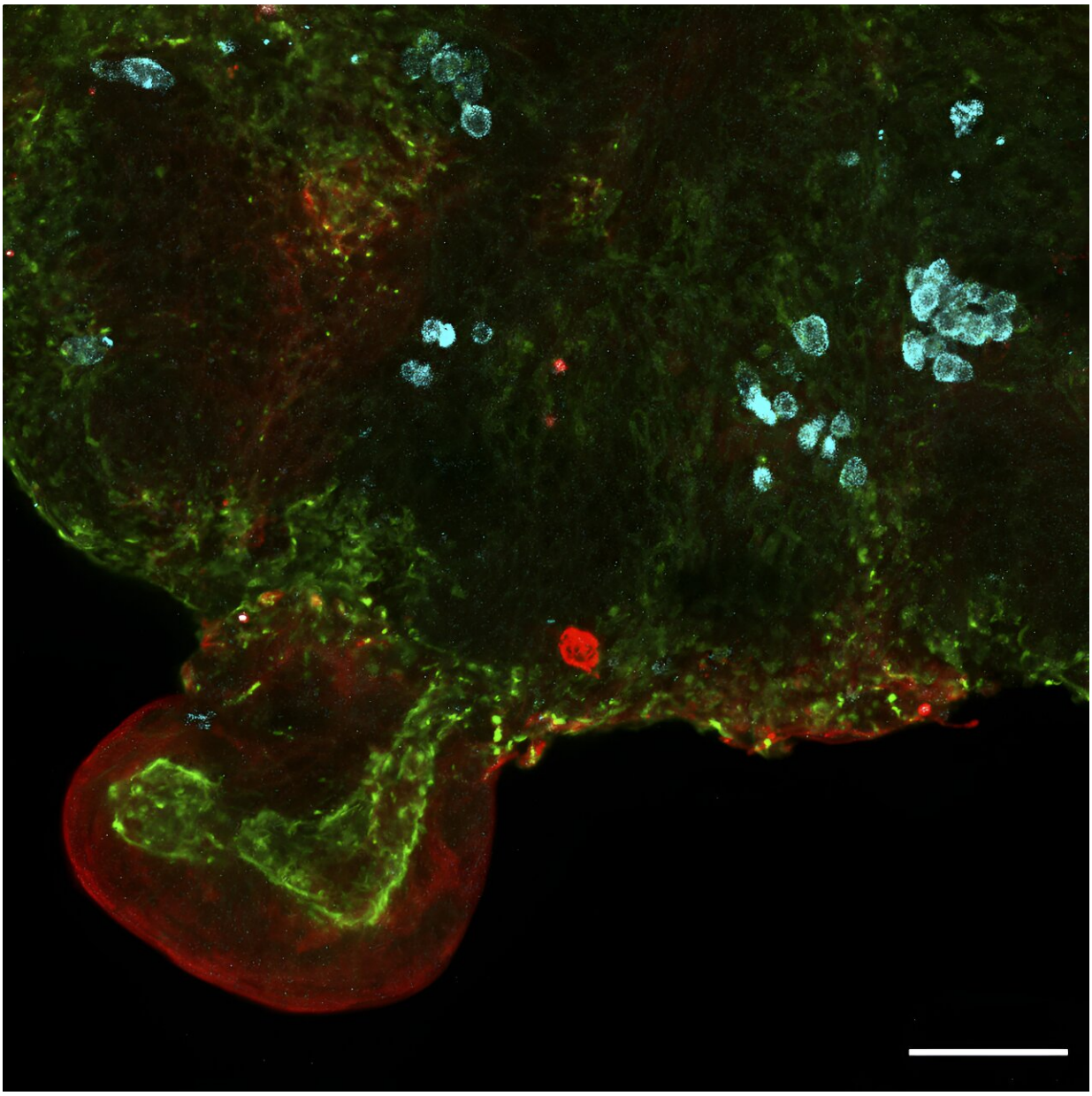
Scientists have created miniorgans from cells floating in the fluid that surrounds a fetus in the womb—an advance they believe could open up new areas of prenatal medicine.

Miniorgans, or " organoids," are tiny simplified structures that can be used to test new medical treatments or study how the real organs they mimic work, whether they are healthy or diseased.

Researchers from University College London and Great Ormond Street Hospital in the United Kingdom collected cells from amniotic fluid samples taken during 12 pregnancies as part of routine prenatal testing. Then, for the first time, they grew mini-organs from cells taken during active pregnancies. They envision their approach could eventually help doctors monitor and treat congenital conditions before birth and develop personalized therapies for a baby in the womb.

"We're really excited" about that possibility, said Mattia Gerli of University College London, an author of the study published Monday in the journal *Nature Medicine*.

The tissue-specific stem cells Gerli and his colleagues collected were shed by the fetus, as normally happens during pregnancy. The scientists identified which tissues the stem cells came from, and found cells from the lungs, kidneys and intestines.



This microscope image provided by researchers in March 2024 shows an intestinal organoid with its distinctive 'bud' structure, created from cells collected from amniotic fluid. In a study published Monday, March 4, 2024, in the journal *Nature Medicine*, scientists in the United Kingdom described how they have made mini-organs from cells floating in amniotic fluid – an advance they believe could open up new areas of prenatal medicine. Credit: Giuseppe Calà, Paolo De Coppi, Mattia Gerli via AP

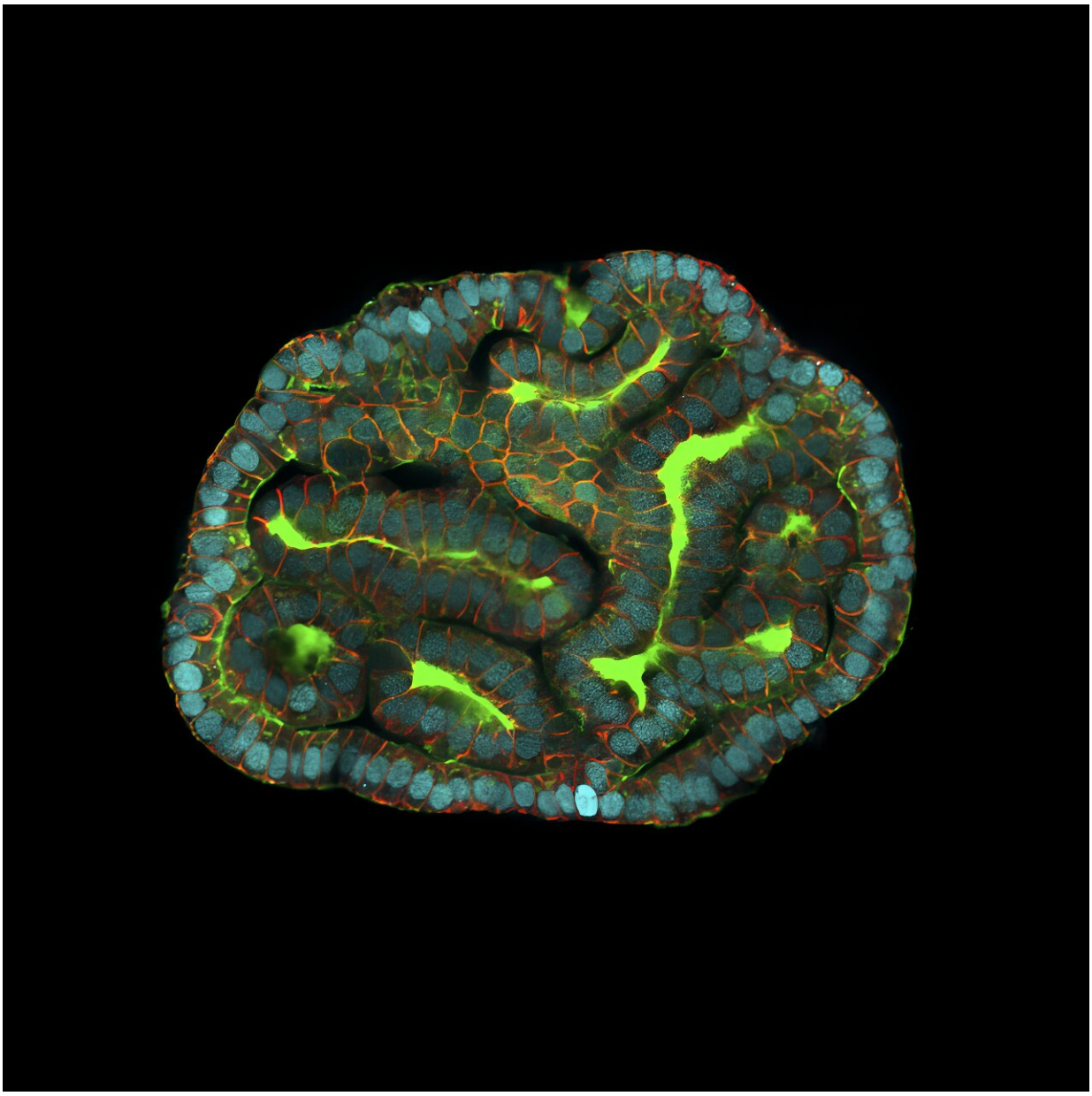
Previously, mini-organs have been derived from adult stem cells, which more closely resemble adult tissue, or fetal tissue after an abortion.

Collecting cells from amniotic fluid gets around regulations about taking stem cells directly from fetal tissue, allowing these scientists to get cells from fetuses into the latter part of pregnancy. In the U.K., the legal limit for terminating a pregnancy is generally 22 weeks after conception. Scientists can't get fetal samples after that, limiting their ability to study normal human development or congenital diseases past that point.

In the U.S., abortion restrictions vary by state. It's legal in most to use fetal tissue for research, said Alta Charo, an emeritus professor of law and bioethics at the University of Wisconsin at Madison. Fetal tissue is defined by the National Institutes of Health as coming from a dead human embryo or fetus after a miscarriage, abortion or stillbirth—and the use of tissue from an abortion has long been controversial.

Charo, who wasn't involved in the study, said the new approach doesn't raise the same ethical issues. "Obtaining cells from amniotic fluid that is already being sampled for standard clinical purposes does not appear to add any physical risks to either fetus or pregnant woman," she said in an email.

Dr. Arnold Kriegstein, who directs the Developmental and Stem Cell Biology Program at the University of California, San Francisco, and also wasn't involved in the research, said getting cells this way has "the potential of giving you some information about that individual fetus as it's growing."



This microscope image provided by researchers in March 2024 shows a kidney organoid resembling renal tubules, created from cells collected from amniotic fluid. In a study published Monday, March 4, 2024, in the journal *Nature Medicine*, scientists in the United Kingdom described how they have made mini-organs from cells floating in amniotic fluid – an advance they believe could open up new areas of prenatal medicine. Credit: Giuseppe Calà, Paolo De Coppi, Mattia Gerli via AP

And since growing mini-organs from cells in amniotic fluid takes about 4 to 6 weeks, Gerli said, there's enough time for prenatal therapy to fix problems doctors might find.

To examine one practical use of their approach, the U.K. team worked with colleagues in Belgium to study the development of babies with a condition called a congenital diaphragmatic hernia, in which organs such as the liver and intestines get displaced into the chest because of a hole in the diaphragm. The lungs don't develop the way they should, and about 30% of fetuses with the condition die. If doctors detect the hernia, they can operate on the fetus while it's still in the womb.

Researchers grew lung organoids from the cells of fetuses with the condition before and after treatment and compared them to organoids from healthy fetuses. Dr. Paolo de Coppi, an author of the study from University College London and Great Ormond Street Hospital, said they were able to assess the affected child's condition before birth using this method. Doctors are now unable to tell families much about the outcome of a prenatal diagnosis because each case is different, he said. The ability to study functioning prenatal miniorgans, he added, is the first step toward a more detailed prognosis and more effective treatments.

Kriegstein said more research is needed. "It's in the very early stages," he added, "and we'll have to wait and see how useful it'll be in the long run."

More information: Mattia Gerli, Single-cell guided prenatal derivation of primary fetal epithelial organoids from human amniotic and tracheal fluids, *Nature Medicine* (2024). DOI: 10.1038/s41591-024-02807-z.
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