of recent exposure to similar viruses. But a growing number of researchers think that the difference between adults and children might be the condition of their blood vessels.

Many adults with serious COVID-19 experience clotting in their blood vessels, which leads to heart attacks or strokes. The clotting seems to be linked to a malfunctioning endothelium, the smooth tissue that lines blood vessels and normally prevents clotting, says Frank Ruschitzka, a cardiologist at the University Hospital Zurich in Switzerland. Normally, blood clots form only to stop bleeding from an injury, but if the endothelium is damaged, clots can also form.

Ruschitzka and his colleagues have found that SARS-CoV-2 can infect endothelial cells, which are found throughout the body. In a study of three people with COVID-19, two of whom died, Ruschitzka's team found that SARS-CoV-2 had infected the endothelium and caused inflammation and signs of clotting (Z. Varga *et al. Lancet* **395**, 1417–1418; 2020). The study was small, so such complications will need to be investigated further, but problems with the endothelium seem to be involved in most cases of COVID-19 that progress to severe or fatal disease in adults, he says.

The endothelium is typically in much better condition in children than in adults. "A kid's endothelium is set up perfectly and then just deteriorates with age," says Paul Monagle, a paediatric haematologist at the Melbourne Children's Campus in Australia.

Monagle and others think that children's blood vessels are better able to withstand a viral attack than are adults'. Further support for this theory is the observation that few children with COVID-19 present with excessive clotting and damaged vessels, he says.

Monagle is trying to understand what happens when the virus enters endothelial cells. He thinks it probably disrupts communication between the cells, platelets and plasma components involved in clotting, and that this communication breakdown leads to excess clots.

He has launched experiments to try to understand this mechanism and to see whether there is something protective about kids' blood vessels that makes them less likely to produce excess clots in response to viral infection. In the first experiment, his team will try to recreate conditions inside the blood vessels of children and adults in the laboratory. The researchers will take cultured endothelial cells infected with SARS-CoV-2 and bathe them in plasma from three sources – children, healthy adults and adults with vascular disease. By comparing how the infected cells interact with the different types of plasma, they should be able to see what makes the signalling in the vessels go awry.

Monagle hopes that studying samples from children will offer clues about what's going wrong in some adults.

LAB-GROWN CELLS MIMIC CRUCIAL MOMENT IN EMBRYO DEVELOPMENT

Artificial structures have developed the rudimentary components of a heart and nervous system.

By David Cyranoski

Scientists have created embryo-like structures that mimic a crucial yet enigmatic stage of human development.

The structures, created from stem cells and called gastruloids, are the first to form a 3D assembly that lays out how the body will take shape. The gastruloids developed rudimentary components of a heart and nervous system, but lacked the components to form a brain and other cell types that would make them capable of becoming a viable fetus.

Researchers are creating ever more sophisticated artificial structures to study embryo development in the laboratory. The latest method for making these structures, published in *Nature* on 11 June, could shed light on the causes of pregnancy loss and early developmental disorders, such as congenital heart conditions and spina bifida (N. Moris *et al. Nature* http://doi.org/dzhm; 2020).

The model could help scientists to understand the role of genetics and environmental factors in such disorders, says Fu Jianping, a bioengineer at the University of Michigan in Ann Arbor. "That is now on the horizon."

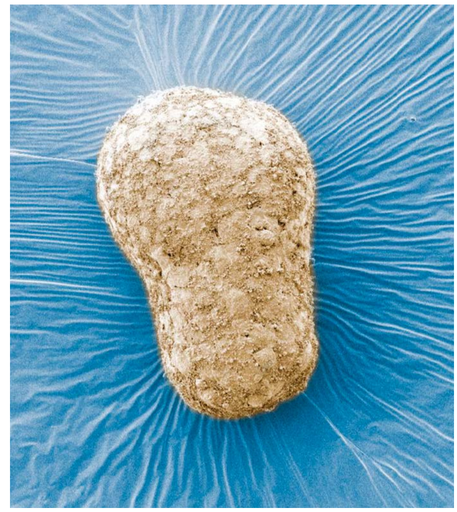
"This is a new system that opens up a whole host of questions."

The artificial structures make it possible to avoid some of the ethical concerns about doing research on human embryos. But as the structures become more advanced and life-like, they, too, might push ethical boundaries, scientists say.

Body blueprint

Human embryos take a momentous leap in their third week, when the largely homogeneous ball of cells starts to differentiate and develop specific characteristics of the body parts they will become, a process known as gastrulation. During this process, the embryo elongates and lays down a body plan with a head and 'tail', often called the head-to-tail axis.

But scientists have never seen this process in action. That is partly because many countries



NAOMI MORIS

Gastruloid structures mimic processes in early embryos.

have regulations that stop embryos from being grown in the laboratory for research beyond 14 days after conception.

Over the past year, several research groups have cultured embryonic stem-cell structures that model when cells start to differentiate. The latest model, developed by Naomi Moris and Alfonso Martinez Arias, developmental biologists at the University of Cambridge, UK, and their colleagues in the Netherlands, is the first to show what happens when the blueprint for the body's development is laid out, around 18–21 days after conception.

"This important finding will help us to understand the critical mechanisms of human body planning," says Li Tianqing, a developmental biologist at the Institute of Primate Translational Medicine in Yunnan, China, who also works on embryo-like structures.

The most thrilling result, Moris says, was the formation of pockets of cells that symmetrically straddle the head-to-tail axis. Genetic analysis showed that the cells were those that would eventually go on to form muscles in the trunk, vertebrae, heart and other organs.

Moris says the embryo model will help scientists to study how the pattern of cells emerges, and where it can go wrong. Many diseases are caused by errors in this process, including scoliosis, which causes curvature of the spine. "This is a new system that opens up a whole host of questions," she says.