Study suggests that aging begins in the womb

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The process of aging begins even before we are born, according to an international team of researchers, including lead author Dr Beth Allison who has now returned to The Ritchie Centre at Hudson Institute of Medical Research and Monash University in Melbourne.

Researchers in the University of Cambridge-led study used rats to model pregnancy and fetal development, finding that providing mothers with antioxidants during late pregnancy meant that their offspring aged more slowly in adulthood.

However, the offspring of mothers with lower levels of oxygen in the womb – which, in humans, can be a consequence of smoking during pregnancy or of pregnancy at high altitude – aged more quickly in adulthood.

Dr Allison, from The Ritchie Centre, Hudson Institute of Medical Research and Monash University, who carried out her work while at the University of Cambridge, says the paper shows for the first time that the anti-ageing properties of antioxidants may extend to unborn children.

"Antioxidants are known to reduce ageing, but here, we show for the first time that giving them to pregnant mothers in the latter half of gestation can slow down the ageing clock of their offspring," Dr Allison said.

"This appears to be particularly important when there are complications with the pregnancy and the fetus is deprived of oxygen. Although this discovery was found using rats, it suggests a way that we may treat similar problems in humans."

Our DNA is 'written' onto chromosomes, of which humans carry 23 pairs. The ends of each chromosome are known as telomeres and act in a similar way to the plastic that binds the ends of shoelaces, preventing the chromosomes from fraying. As we age, these telomeres become shorter and shorter, and hence their length can be used as a proxy to measure ageing.

In the study funded by the British Heart Foundation and published today in The *FASEB Journal*, scientists report a study that involved measuring the length of telomeres in blood vessels of adult laboratory rats born from mothers who were or were not fed antioxidants during normal or complicated pregnancy.

The most common complication in pregnancy is a reduction in the amount of oxygen that the baby receives – this can be due to a number of causes, including expectant mothers who smoke or who experience preeclampsia. To simulate this complication, the researchers placed a group of pregnant laboratory rats in a room containing 7 per cent less oxygen than normal.

The researchers found that adult rats born from mothers who had less oxygen during pregnancy had shorter telomeres than rats born from uncomplicated pregnancies, and experienced problems with the inner lining of their blood vessels – signs that they had aged more quickly and were predisposed to developing heart disease earlier than normal. However, when pregnant mothers in this group were given antioxidant supplements, this lowered the risk among their offspring of developing heart disease.

Even the offspring born from uncomplicated pregnancies – when the fetus had received appropriate levels of oxygen – benefited from a maternal diet of antioxidants, with longer telomeres than those rats whose mothers did not receive the antioxidant supplements during pregnancy.

Professor Dino Giussani from the Department of Physiology Development & Neuroscience at the University of Cambridge, the study's senior author, said: "Our study in rats suggests that the ageing clock begins ticking even before we are born and enter this world, which may surprise many people.

"We already know that our genes interact with environmental risk factors, such as smoking, obesity and lack of exercise to increase our risk of heart disease, but here we've shown that the environment we're exposed to in the womb may be just as, if not more, important in programming a risk of adult-onset cardiovascular disease."

Provided by Monash University