Medical Xpress

Researchers develop new tool to find molecular changes in embryos

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(Medical Xpress)—A combined team of researchers from the U.S. and Singapore has developed a new tool to help spot molecular changes in embryos. As the team describes in their paper published in the journal *Science*, the new technique may help to identify and possibly prevent some birth defects.

The new tool came about as researchers were looking into ways to detect DNA methylation errors in mice. In mammals, embryos undergo what is known as imprinting—where just one of the genes from the father or mother are expressed. Defects that occur at this stage can lead to birth defects. Prior research has shown that such defects can occur into two main ways: genetic mutations and mutations that occur in the chemicals that are used to carry out certain functions, such as creating other chemicals needed for normal growth of the embryo. Research in this area has been notoriously difficult due to the delicate nature of embryos—attempts to take samples tend to cause irreparable harm. In this new effort, the team has developed a technique that allows for noting molecular changes in the mice embryos that doesn't adversely impact them.

The single-cell DNA methylation analysis technique they developed involved use of a quantitative polymerase chain reaction that involved a methylation-sensitive restriction digest in a microfluidic device. Their analysis focused on six specific genes that are typically involved during imprinting. Their method allowed them to note when normal changes did not occur—in one case, leading to chimerism.

Because their technique allowed the researchers to note when mutations occurred, it also allowed for attempting to make corrections using a technique called pronuclear transfer—where normal zygotic DNA is transferred to a growing embryo. The team reports that doing so resulted in 17 percent of attempts resulting in the development of healthy pups—with no signs of birth defects being passed on to their young.

It's still too early to tell if the technique developed by the team will translate into developing such a method for detecting and possibly circumventing mutations that lead to birth defects in humans, but the researchers are optimistic suggesting more research may lead to heading off a host of human syndromes.

More information: Single-Cell DNA-Methylation Analysis Reveals Epigenetic Chimerism in Preimplantation Embryos, *Science* 6 September 2013: Vol. 341 no. 6150 pp. 1110-1112 DOI: 10.1126/science.1240617

ABSTRACT
Epigenetic alterations are increasingly recognized as causes of human cancers and disease. These aberrations are likely to arise during genomic reprogramming in mammalian preimplantation embryos, when their epigenomes are most vulnerable. However, this process is only partially understood because of the experimental inaccessibility of early-stage embryos. Here, we introduce a methodologic advance, probing single cells for various DNA-methylation errors at multiple loci, to reveal failed maintenance of epigenetic mark results in chimeric mice, which display unpredictable phenotypes leading to developmental arrest. Yet we show that mouse pronuclear transfer can be used to ameliorate such reprogramming defects. This study not only details the epigenetic reprogramming dynamics in early mammalian embryos but also suggests diagnostic and potential future therapeutic applications.