Chinese team uses CRISPR to genetically modify human embryo

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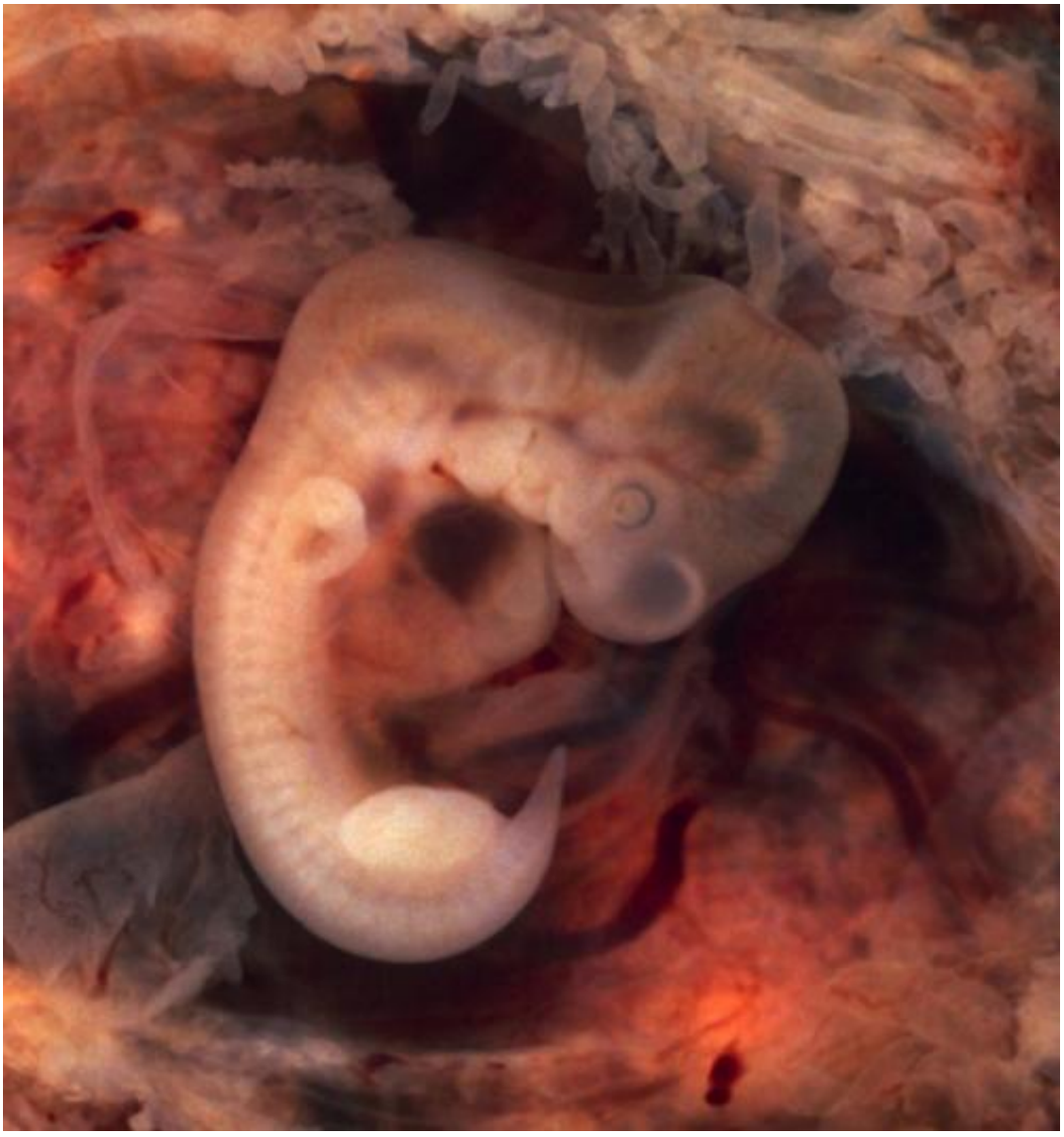

Human Embryo. Credit: Ed Uthman, MD/Wikipedia

(Medical Xpress)—A team of researchers at Guangzhou Medical University in China has published a paper in the *Journal of Assisted Reproduction and Genetics* describing their efforts to genetically modify a human embryo using CRISPR/Cas9, the gene editing technique. The research, the team reports, was carried out on embryos that carried an extra set of chromosomes, and thus were not viable.

Doing any sort of genetic modification on human embryos is, of course, quite controversial—most medical researchers believe that one day such practices will be common, but today, so much is still unknown regarding the consequences of such procedures that most of the world has decided to hold off doing such research until much more has been learned. Indeed it was just a year ago that a different team in China published results of another study that involved editing human embryo genes, causing a stir in both the medical and ethical community.

In this latest effort, the Chinese team reports that they obtained 213 fertilized eggs from a fertility clinic, which had been deemed unsuitable for in vitro therapy. The women who had donated the eggs all gave permission for the embryos to be used for genetic research, on condition that the embryos would not be allowed to mature into a human being. The team used the CRISPR technique to edit genes, adding a mutation that causes damage to an immune cell gene called CCR5—such cells that are damaged naturally have been found to lead to HIV resistance. Thus the point of the research was to learn more about the possibility of producing human babies that would be immune to HIV. The team reports that just 4 out of 26 of the embryos that were edited were modified successfully—some still contained genes that had not been modified, and others had resulted in unexpected gene mutations. All of the embryos were destroyed after three days. Due to the results, it is not clear what has been learned from the experiments, except that some groups, particularly in China, are willing to conduct such research despite international condemnation.

It is likely that news of the work done by the team in China will spark a new round of discussions regarding such research, and others will no doubt condemn the team for what they have done—but the researchers are neither apologizing nor backing down—instead they suggest that such research is paving the way for future efforts while also noting that they have no intention of allowing genetically modified embryos to mature—once the rest of the world is ready to join them, they suggest, a path for moving forward will have already been laid.

More information: Xiangjin Kang et al. Introducing precise genetic modifications into human 3PN embryos by CRISPR/Cas-mediated genome editing, *Journal of Assisted Reproduction and Genetics* (). DOI: 10.1007/s10815-016-0710-8

Abstract

Purpose
As a powerful technology for genome engineering, the CRISPR/Cas system has been successfully applied to modify the genomes of various species. The purpose of this study was to evaluate the technology and establish principles for the introduction of precise genetic modifications in early human embryos.
Methods
3PN zygotes were injected with Cas9 messenger RNA (mRNA) (100 ng/μl) and guide RNA (gRNA) (50 ng/μl). For oligo-injections, donor oligo-1 (99 bp) or oligo-2 (99 bp) (100 ng/μl) or dsDonor (1 kb) was mixed with Cas9 mRNA (100 ng/μl) and gRNA (50 ng/μl) and injected into the embryos.
Results
By co-injecting Cas9 mRNA, gRNAs, and donor DNA, we successfully introduced the naturally occurring CCR5Δ32 allele into early human 3PN embryos. In the embryos containing the engineered CCR5Δ32 allele, however, the other alleles at the same locus could not be fully

controlled because they either remained wild type or contained indel mutations.

Conclusions

This work has implications for the development of therapeutic treatments of genetic disorders, and it demonstrates that significant technical issues remain to be addressed. We advocate preventing any application of genome editing on the human germline until after a rigorous and thorough evaluation and discussion are undertaken by the global research and ethics communities.