HEALTH & SCIENCE

CRISPR/Cas9 Technology
Gene Editing – Eugenics?

American and Korean scientists published an article in *Nature* announcing they successfully edited a single gene in human embryos. Lauran Neergaard reported at AP that "researchers safely repaired a disease-causing gene [MYBPC3] in human embryos, targeting a heart defect best known for killing young athletes – a big step toward one day preventing a list of inherited diseases… a research team led by Oregon Health & Science University reported that embryos can help fix themselves if scientists jump-start the process early enough…Previous embryo-editing attempts in China found not every cell was repaired, a safety concern called mosaicism. Beginning the process before fertilization avoided that problem."

Neergaard reported, "The team programmed a gene-editing tool, named CRISPR-Cas9, that acts like a pair of molecular scissors to find that mutation – a missing piece of genetic material… Researchers injected sperm from a patient with the heart condition along with those molecular scissors into healthy donated eggs at the same time. The scissors cut the defective DNA in the sperm. Normally cells will repair a CRISPR-induced cut in DNA by essentially gluing the ends back together. Or scientists can try delivering the missing DNA in a repair package, like a computer's cut-and-paste program. Instead, the newly forming embryos made their own perfect fix without that outside help, reported Oregon Health & Science University senior researcher Shoukhrat Mitalipov." Neergaard continued, "It worked 72% of the time, in 42 out of 58 embryos. Normally a sick parent has a 50-50 chance of passing on the mutation."

Mitalipov, stated, "Every generation on would carry this repair because we've removed the disease-causing gene variant from that family's lineage. By using this technique, it's possible to reduce the burden of this heritable disease on the family and eventually the human population." Mitalipov also stated that until now, "everybody was injecting too late." According to Neergaard, the researchers stated that "intense testing [did not] uncover any 'off-target' errors [or] cuts to DNA in the wrong places…**The embryos weren't allowed to develop beyond eight cells,** a standard for laboratory research. The experiments were privately funded; US tax dollars aren't allowed for embryo research."

Victoria Aitken reported at the Daily Mail, "It has the potential to revolutionize medicine and could lead to the eradication of inherited diseases such as cystic fibrosis and breast cancer. Campaigners warned however that it might also open the door to 'superior designer babies' with genes modified to improve physical appearance, strength or even intelligence." Dr. David King of Human Genetics Alert stated, "What concerns me most is that we will start making babies to order, and then expecting them to perform according to the way we have genetically designed them…That is because the nuclear DNA at the heart of a cell, which these scientists tweaked, also determines personal characteristics. This raises the prospect of genetically engineered 'superheroes' made to be more athletic or extra intelligent at the request of parents…But the researchers have edited only a single gene so far, using a technique which has still to be proven to work in babies rather than just embryos."

Neergard said,"' germline' changes – altering sperm, eggs, or embryos – are controversial because they would be permanent, passed down to future generations." She noted that "genetics and ethics experts not involved in the work say it's a critical first step – but just one step – toward eventually testing the process in pregnancy, something currently prohibited by US policy. "This is very elegant lab work, but it's moving so fast that society needs to catch up and debate how far it should go," said Johns Hopkins University bioethicist Jeffrey Kahn. And lots more research is needed to tell if it's really safe, added Britain's Robin Lovell-Badge. He and Kahn were part of a National Academy of Sciences report earlier this year that said if germline editing ever were allowed, it should be only for serious diseases with no good alternatives and done with strict oversight. "What we do not want is for rogue clinicians to start offering treatments" that are unproven… Among key questions: Would the technique work if mom, not dad, harbored the mutation? Is repair even possible if both parents pass on a bad gene? ...Mitalipov said the research should offer critics some reassurance: If embryos prefer self-repair, it would be extremely hard to add traits for 'designer babies' rather than just eliminate disease, "All we did is un-modify the already mutated gene.""

Sciencenews.org reported on 7/5/17 that genes associated with coronary artery disease are also linked to fertility, as well as fetal development and survival. "A June 22nd report in *PLOS Genetics* showed a genetic connection between reproduction and heart disease. The *Sciencenews.org* article concluded, "This study may be a warning for gene therapy, since it suggests there are many genetic connections between different bodily functions that scientists don't yet understand…If scientists want to treat coronary artery disease by editing a person's DNA, it's important to know what other traits might be affected. The new findings also raise questions about the various functions of other disease-related genes…For instance, a future study could examine whether genes associated with cancer have any hidden evolutionary benefits." *Sciencenews.org* also reported on 7/20/17 that resistance to CRISPR gene drives occurred at high rates in experiments with fruit flies.

Michael Cook commented at *Bioedge.org* 8/5/17, "For others, creating and destroying human embryos for research is itself anathema. In this experiment, dozens of embryos were created, and all were destroyed before they had grown beyond a few days. But everyone recognized the potential for a new generation of eugenics, which has so long been under the shadow of the Nazis' discredited ideology. David Albert Jones, of the UK's Anscombe Institute, penned a withering critique, *Unethical research with eugenic goals.* "The whole rationale for this experiment is to take a step towards genetic modification as an assisted reproductive technology. We are manufacturing new human beings for manipulation and quality control, and experimenting on them with the aim of forging greater eugenic control over human reproduction. This is not a case of using bad means for a good end, but of bad means to a worse end.""

Wesley Smith questioned at *LifeNews.com* on 7/27/17 "So are we going to just watch, slack-jawed, the double-time march to *Brave New World* unfold before our eyes? Or are we going to engage democratic deliberation to determine if this should be done, and if so, what the parameters are? …Mr. President: We need a presidential bioethics/biotechnology commission now!"

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