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New Stem Cells With Just Half A Genome Could Reveal Secrets Of Human Reproduction

March 18, 2016 | by Robin Andrews

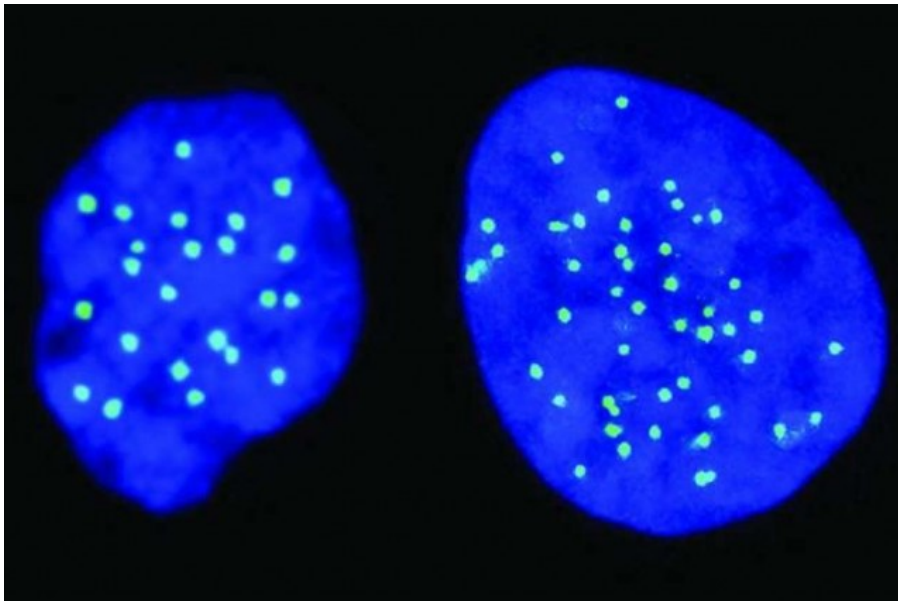


photo credit: A haploid cell with 23 chromosomes (left) next to a diploid cell with all 46. Columbia University Medical Center/Hebrew University

At their most primitive, [stem cells](#) have the ability to become almost any cell in the body, and recent research suggests that they have the ability to revolutionize medical treatments. It may not be long before [curing blindness](#) in children and restoring [damaged heart tissue](#) after a cardiac arrest – things once thought to be impossible – become commonplace.

With this in mind, [the hunt is on](#) for new stem cells, with each discovery potentially giving humanity a new weapon in its regenerative research arsenal. Only this month, [early stage stem cells](#) were produced from human embryos for the first time. Now, a new stem cell, one that only contains half a genome, has been isolated, as revealed in [Nature](#).

Almost all human cells are considered “[diploid](#)” in that they contain two sets of chromosomes – 46 in total, with 23 from the father and 23 from the mother. Reproductive cells are known as “[haploid](#)” cells; with only a single set of 23 chromosomes, they cannot divide to make more eggs or sperm. During fertilization, two haploid cells join together to make a new, self-dividing diploid cell.

Any previous attempt to produce [embryonic stem cells](#), those that are derived from fertilized eggs discarded from [in vitro fertilization](#) (IVF) operations, have always turned out to be diploid. The researchers in this study attempted to break this biological embargo and produce haploid stem cells.

After forcing an unfertilized egg cell to divide using electrical currents and a cocktail of chemicals, the researchers noticed it manufactured another copy of its 23 chromosomes in order to produce diploid cells. Using fluorescent dye to highlight DNA, they were able to spot and isolate a few juvenile haploid cells scattered among far more populous diploid cells.

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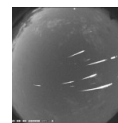
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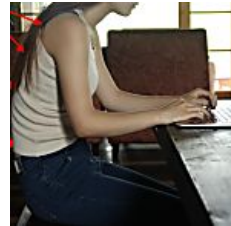
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To their surprise, these haploid cells were able to turn into different types of tissue cells, including those for the heart, digestive tract, and even the brain. This ability makes them a [new type of stem cell](#), the first containing just one set of chromosomes.

“This finding means that obtaining mature cells does not require a diploid genome... a haploid genome is sufficient,” Nissim Benvenisty, a professor of genetics at the Hebrew University of Jerusalem and co-author of the study, told IFLScience. Theoretically, these unusual stem cells could go on to develop an entire human.

The implication here is that reproduction could happen using a single parent's unfertilized egg or perhaps a single sperm cell – so why doesn't it? As these experimentally produced haploid stem cells represent the earliest stage of embryonic development, researchers could use them to understand why humans do not have this ability.

These stem cells could be used to create eggs and sperm for [infertile couples](#), although their most important application would be to help researchers understand how genes are connected to various biological phenomena.

“In diploid cells, mutating just one copy of a gene usually does not produce a biological effect because there is always a second copy that serves as backup,” Benvenisty noted. “Learning... how drugs work in treating certain diseases requires a haploid genome with only one copy of each gene, where every mutation would have an effect that we will be able to learn something from.”

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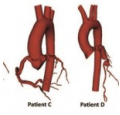
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