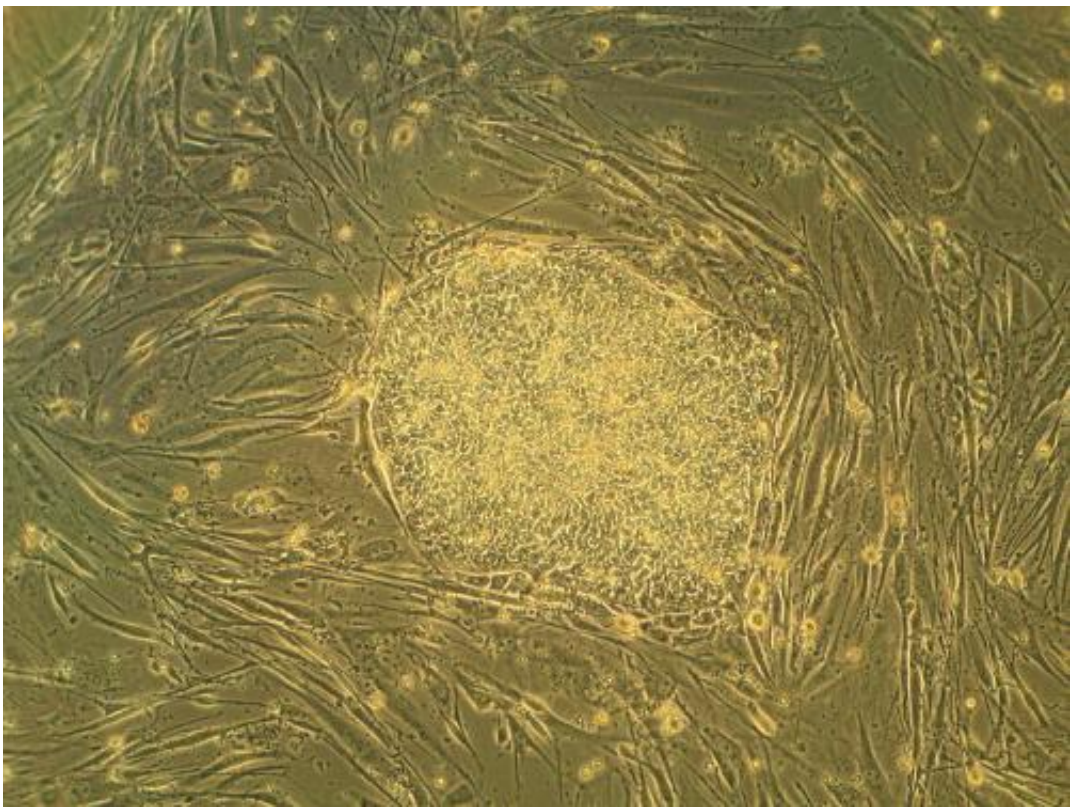
# Researchers discover ancient virus DNA remnants necessary for pluripotency in humans

March 31 2014, by Bob Yirka



Human embryonic stem cells in cell culture. Credit: Wikipedia.

(Phys.org) —A team of Canadian and Singaporean researchers has discovered that remnants of ancient viral DNA in human DNA must be present for pluripotency to occur in human stem cells. In their paper

published in the journal *Nature Structural and Molecular Biology*, the team describes how they disabled a viral remnant in stem cell samples and discovered that doing so prevented the stem cell from being able to grow into all but one type of human cell.

All of the cells in the human body start out as stem cells—the ability of such cells to do so is known as pluripotency. Scientists don't really understand how individual stem cells know which type to become but are working hard to find out—it could lead to the development of cures for many diseases or the regeneration of lost limbs. In this new effort, the researchers wondered about the role of remnant viral DNA in stem cell DNA and pluripotency in general.

Scientists have known for some time that viral DNA exists in human DNA, the result of retrovirus infections millions of years ago. Retroviruses reproduce by injecting their own DNA into the DNA of a host—if it occurs in sperm or egg cells, the virus DNA can end up in the DNA of the host. Until now, scientists have thought that remnant viral DNA was simply "junk" DNA—meaning it didn't do anything at all. Now it appears clear that at least one type of such DNA—HERV-H—actually plays a very important role in pluripotency.

The researchers treated some human stem cells with a small amount of RNA designed to suppress HERV-H. Doing so, they found, removed the stem cell's ability to develop into any human cell—instead they would only grow into cells that resembled fibroblasts—cells normally found in connective tissue. A closer look revealed that suppressing HERV-H also suppressed the production of proteins necessary for pluripotency. Thus, at least in humans, the remnant viral DNA appears to be necessary for normal human development—without it, human life would be impossible.

Because of the role HERV-H plays in pluripotency, its possible other

remnant viral DNA plays a role in human development as well, thus it's very likely that other research efforts will focus on testing each to see if they are more than just junk left over from infections over the course of human evolution.

**More information:** The retrovirus HERVH is a long noncoding RNA required for human embryonic stem cell identity, *Nature Structural & Molecular Biology* (2014) DOI: 10.1038/nsmb.2799


## Abstract

Human endogenous retrovirus subfamily H (HERVH) is a class of transposable elements expressed preferentially in human embryonic stem cells (hESCs). Here, we report that the long terminal repeats of HERVH function as enhancers and that HERVH is a nuclear long noncoding RNA required to maintain hESC identity. Furthermore, HERVH is associated with OCT4, coactivators and Mediator subunits. Together, these results uncover a new role of species-specific transposable elements in hESCs.



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