Citrus surprise: Vitamin C boosts the reprogramming of adult cells into stem cells

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Famous for its antioxidant properties and role in tissue repair, vitamin C is touted as beneficial for illnesses ranging from the common cold to cancer and perhaps even for slowing the aging process. Now, a study published online on December 24th by Cell Press in the journal Cell Stem Cell uncovers an unexpected new role for this natural compound: facilitating the generation of embryonic-like stem cells from adult cells.

Over the past few years, we have learned that adult cells can be reprogrammed into cells with characteristics similar to embryonic stem cells by turning on a select set of genes. Although the reprogrammed cells, called induced pluripotent stem cells (iPSCs), have tremendous potential for regenerative medicine, the conversion is extremely inefficient.

"The low efficiency of the reprogramming process has hampered progress with this technology and is indicative of how little we understand it. Further, this process is most challenging in human cells, raising a significant barrier for producing iPSCs and serious concerns about the quality of the cells that are generated," explains senior study author Dr. Duanqing Pei from the South China Institute for Stem Cell Biology and Regenerative Medicine at the Guangzhou Institutes of Biomedicine and Health, Chinese Academy of Sciences.

Dr. Pei and colleagues measured the production of reactive oxygen species or ROS during reprogramming and discovered a potential link between high ROS and low reprogramming efficiency. They became particularly interested in antioxidants, hypothesizing that they might suppress ROS and cell senescence, which seems to be a major roadblock for the generation of iPSCs.

The researchers found that adding vitamin C, an essential nutrient that is abundant in citrus fruits, enhanced iPSC generation from both mouse and human cells. Vitamin C accelerated gene expression changes and promoted a more efficient transition to the fully reprogrammed state. Somewhat to their surprise, they found that other antioxidants do not have the same effect, but vitamin C does seem to act at least in part through slowing cell senescence.

"Our results highlight a simple way to improve iPSC generation and provide additional insight into the mechanistic basis of reprogramming," concludes Dr. Pei. "It is also of interest that a vitamin with long-suspected anti-aging effects has such a potent influence on reprogramming, which can be considered a reversal of the aging process at the cellular level. It is likely that our work may stimulate further research in this area as well."

More information: Esteban et al.: “Report: Vitamin C Enhances the Generation of Mouse and Human Induced Pluripotent Stem Cells.” Publishing in Cell Stem Cell, January 8, 2010. www.cellstemcell.com

Source: Cell Press