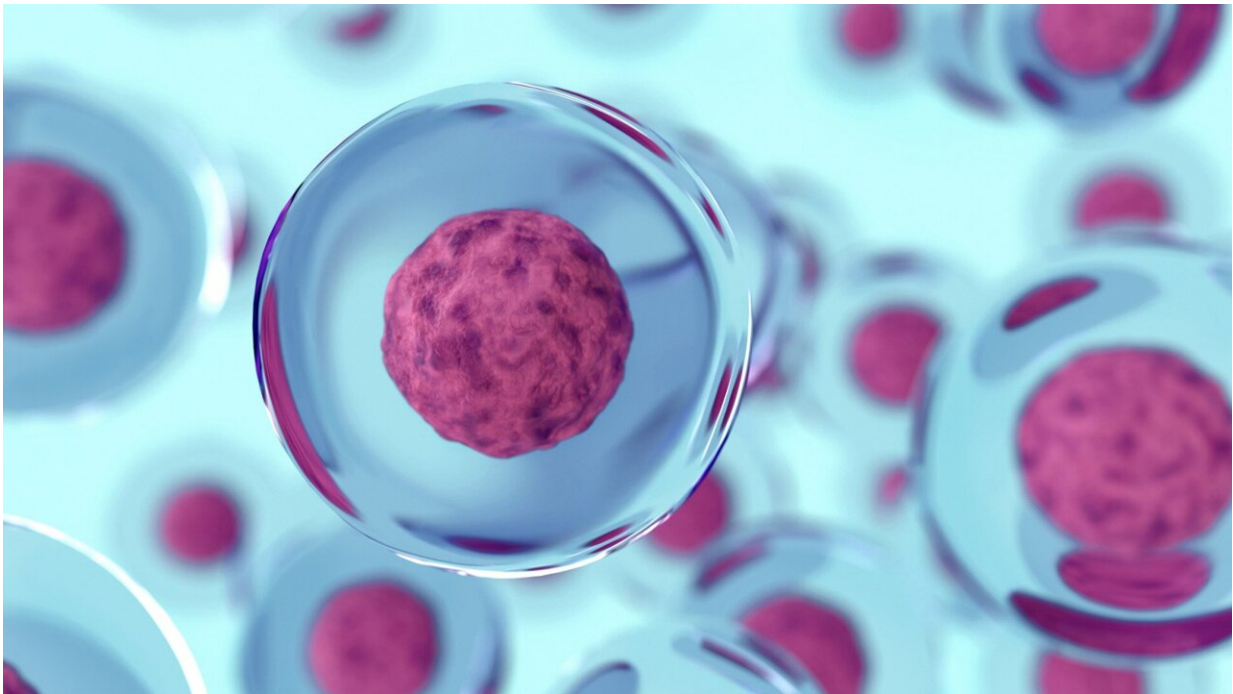


Scientists find key element that affects how genes are expressed in blood stem cells

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The discovery by CSI Singapore researchers will likely improve the understanding of how normal stem cells function, and could possibly lead to insights into disease. Credit: National University of Singapore

The living organism is kept alive and healthy by an intricate network of biochemical processes. These are remarkably resilient in responding to changes in the environment, but they can sometimes go wrong. A key tenet of medicine is to understand these pathways in order to treat

disease more effectively.

Now a research team, led by Professor Daniel Tenen of the Cancer Science Institute of Singapore (CSI Singapore) at the National University of Singapore (NUS), has found a major molecular "switch" that controls how [cells](#) turn their [genes](#) on and off. This process ensures the cell correctly and adequately performs its assigned tasks in the body.

The scientists used hematopoietic stem cells as a [case study](#). These are vital cells that replenish the body's blood cells throughout life.

A cell's genes are encoded in long DNA strands, which are coiled up into highly elaborate structures called chromosomes. For the correct genes to be expressed at the correct times and in correct amounts in the cell, the shape of the chromosomes must be adjusted constantly. This is done by a [protein](#) called CTCF, which binds to parts of the DNA that have a particular sequence of codes and makes a loop in the DNA that activates the necessary gene.

However, the scientists found another protein called ZF143 that controls the activity level of CTCF. This so-called "zinc finger protein" has a protruding molecular appendage that holds a zinc atom and gives the protein the desired chemical properties.

The scientists deactivated ZNF143 by locating and deleting its gene using molecular markers. They found that [hematopoietic stem cells](#) without ZNF143 were unable to make new blood cells. In this case, it could cause serious diseases like anemia.

The team's findings were published in the journal *Nature Communications*.

Their discovery will likely improve the understanding of how normal

stem cells function, and could possibly lead to insights into disease. Prof Tenen said, "Findings from this study has advanced our understanding of the regulatory mechanisms of CTCF-DNA binding and gene expression. It will be of great interest to investigate whether these findings have relevance to developmental disorders and cancers."

Moving forward, the team plans to study the molecular structure of the proteins involved to further understand the process and how it can be modified.

More information: Qiling Zhou et al. ZNF143 mediates CTCF-bound promoter–enhancer loops required for murine hematopoietic stem and progenitor cell function, *Nature Communications* (2021). [DOI: 10.1038/s41467-020-20282-1](https://doi.org/10.1038/s41467-020-20282-1)

Provided by National University of Singapore

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