Biologists theorize role for DNA packaging in stem cell development

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MIT biologists have discovered that the organization of DNA's packing material plays a critical role in directing stem cells to become different types of adult cells.

The work, to be published in the journal *Cell* on Nov. 14, could also shed light on the possible role of DNA packaging in cancer development.

Led by Laurie Boyer, assistant professor of biology at MIT, the researchers examined the role of chromatin — the structure that forms when DNA is wound around a core of proteins called histones.

"We're particularly interested in how chromatin structure influences gene expression and ultimately cell fate," Boyer said. "We hope the studies we are doing can lead to better understanding of development as well as certain diseases."

It has been theorized that cancer cells may overexpress genes involved in early embryonic development, allowing them to proliferate unchecked and regress from adult tissue cells to a stem cell-like state.

Such regression could be partly mediated by changes in chromatin. This packaging is believed to help control DNA transcription because the more tightly wound the chromatin is, the less accessible DNA is to be transcribed.

The new study focused on a variant type of histone known as H2AZ,

which other researchers have recently identified as a protein of interest in cancer.

While H2AZ is ubiquitously expressed in many cell types including adult cells, it is known to be essential for normal embryonic development. The new research reveals why: The variant histones are found near the promoter regions of a particular set of genes that are important for development.

The same genes are also regulated by a group of proteins known as Polycomb group (PcG) proteins, which act as gene silencers.

"It suggests that this histone variant — along with the Polycomb group proteins — may act as some kind of regulatory switch that mediates cell fate transitions," Boyer said. "We hypothesize that they're working together, and that allows these genes to be silent yet poised for activation in stem cells."

In future studies, Boyer's team plans to look at patterns of H2AZ distribution in cancerous cells.

Source: Massachusetts Institute of Technology