

Physical link between RNA processing and epigenetic silencing discovered

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RNA-mediated chromatin regulation is central to gene expression in many organisms but until now the mechanism of how RNA regulates chromatin packaging of DNA, and thereby switches genes on and off, has remained poorly understood.

However, a new paper by Dr. Xiaofeng Fang from the Professor Caroline Dean lab has been able to show how proteins that shape

chromatin and RNA processing machinery physically interact. This establishes how processing of antisense RNA can influence chromatin state and quantitatively regulate expression of the *Arabidopsis thaliana* FLC locus.

The team used a method—termed cross-linked nuclear immunoprecipitation and [mass spectrometry](#) (CLNIP–MS) – previously developed by the group with protein experts in the John Innes Centre's Proteomics team, which uses formaldehyde to capture [protein](#) interactions in plants that otherwise would be too transient to study.

In the paper, the researchers detail how the antisense RNA COOLAIR binds to 3' RNA processing factors that carry out RNA processing. The team then showed these 3' RNA processing factors dynamically associate with proteins that change the architecture of chromatin, called FLD/LD/SD626 and together, this complex blocks the ability for genes to be switched on.

Lead author Dr. Xiaofeng Feng explains; "This work is a significant step towards understanding RNA-mediated chromatin silencing generally. We have been able to mechanistically link RNA processing factors with chromatin-modifiers."

These newly defined physical associations result in chromatin changes that switch off FLC, a key gene regulating flowering. If either the 3' processing factors or [chromatin](#) modifiers are removed, the gene is switched on.

Interestingly, this process shows similarities with gene regulation in yeast, though the exact equivalent mechanism in yeast remains unknown. The conservation of epigenetic mechanisms means this work is relevant for understanding how [genes](#) are switched on and off in all organisms.

More information: Xiaofeng Fang et al. The 3' processing of antisense RNAs physically links to chromatin-based transcriptional control, *Proceedings of the National Academy of Sciences* (2020). [DOI: 10.1073/pnas.2007268117](https://doi.org/10.1073/pnas.2007268117)

Provided by John Innes Centre

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