**Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)**
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# Small proteins, big impact: Why SUMO Proteins are crucial for chromosomes

Press Release

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Gatersleben, 09.12.2025 **The kinetochore protein complex plays a key role in chromosome behaviour and is therefore essential for cell division. A research team at the IPK Leibniz Institute has now discovered that small proteins from the SUMO family are of particular importance for the kinetochore of the model plant *Arabidopsis thaliana*. The results of their study were recently published in the journal Plant Communications.**

Cell division is essential for the correct transmission of genetic information. Each chromosome contains a centromere, a region that plays a central role in controlling chromosome movement during cell division. The kinetochore protein complex forms at the centromere and serves as an attachment site for microtubules. KINETOCHORE NULL2 (αKNL2) is a critical kinetochore protein that plays a central role in loading the centromeric histone H3 (CENH3) onto centromeres and in forming the kinetochore.

For the kinetochore to function correctly, many protein components must act in a coordinated manner. Among these regulators, proteins of the SUMO (Small Ubiquitin-related Modifiers) family play a particularly critical role. Small SUMO proteins can be covalently attached to target proteins, including kinetochore components - a process known as SUMOylation. This modification can alter a protein's stability, localisation, interactions, or overall activity, and is essential for fine-tuning numerous cellular processes.

In this study, the IPK team identified several αKNL2-interacting proteins belonging to the SUMOylation pathway, suggesting that SUMO regulates αKNL2. "We identified that αKNL2 is modified by SUMO proteins and demonstrated how this SUMOylation affects its function," explained Manikandan Kalidass, first author of the study. Using biochemical experiments and computer-based analysis, the researchers also mapped specific SUMO attachment sites in the C-terminal region of αKNL2.

In the next step, the team investigated what happens when these SUMO attachment sites are changed, and αKNL2 can no longer be properly SUMOylated. Dr. Inna Lermontova, head of IPK's research group "Kinetochore Biology", added: "The SUMO sites on αKNL2 are crucial for its normal activity. When SUMOylation is disrupted, the model plant develops growth and fertility defects."  At the cellular level, reduced SUMOylation weakens the interaction between αKNL2 and CENH3 and destabilises the kinetochore, causing chromosome segregation errors that lead to the observed developmental problems.

The study demonstrates how vital this regulatory mechanism is for αKNL2 activity in *Arabidopsis thaliana*. "Our results provide a better understanding of how SUMOylation regulates protein function during chromosome segregation. And this could have implications for similar mechanisms in other eukaryotic systems," said Dr. Inna Lermontova.

**Original publication:**

Kalidass, M., *et al.* (2025): The C-terminal SUMOylation-dependent regulation of αKNL2 governs its centromere targeting and interaction with CENH3. Plant Communications.
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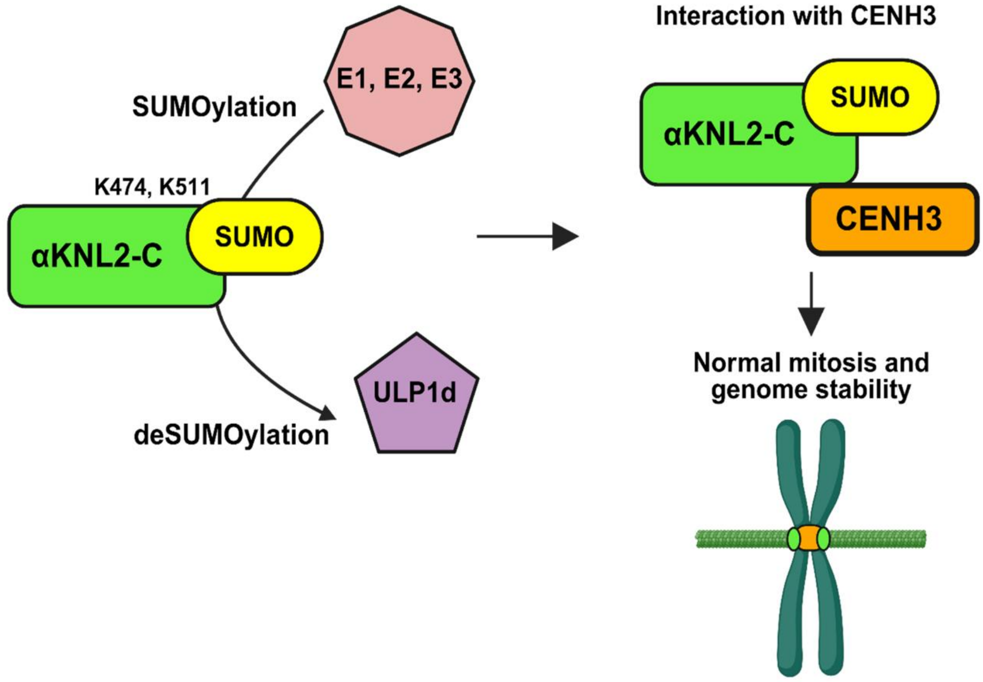
**Graphic:**




Schematic model showing that reversible SUMOylation of αKNL2-C is required for its proper function in centromere assembly and normal cell division.