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The key protein βKNL2 regulates the correct distribution of chromosomes in *Arabidopsis thaliana*

Press Release

Scientific Contact
Dr. Inna Lermontova
Phone: +49 39482 5570
lermonto@ipk-gatersleben.de

Media Contact
Christian Schafmeister
Phone: +49 39482 5461
schafmeister@ipk-gatersleben.de

Gatersleben, 03.07.2026 **An international research team led by the IPK Leibniz Institute has discovered a mechanism that ensures plant cells reliably pass on their genetic material during cell division. The protein βKNL2 plays a key role in this process. Using the model plant *Arabidopsis thaliana*, the researchers demonstrated how the protein finds its correct position on chromosomes, interacts with other molecules, and thus contributes to the formation of the kinetochore, a central protein complex that is important for the distribution of chromosomes. The study was published in the journal 'Nucleic Acids Research'.**

In order for new leaves, roots, flowers, or even seeds to develop from a single cell, the genetic material must be distributed precisely between the daughter cells during each cell division. Even the tiniest errors can cause essential information to be lost, or chromosomes to be distributed incorrectly. The so-called kinetochore plays a key role in this process. This is a central protein complex that forms at the centromere of the chromosome. The centromere is the region to which the spindle fibres attach during cell division, to ensure correct distribution to the daughter cells.

During cell division, fine protein fibres - known as spindle fibres - pull the chromosomes apart and distribute them to the daughter cells. The kinetochore connects the chromosome to the spindle fibres and ensures that the genetic information is transferred completely and safely to the correct location. The main difficulty, however, is that the cell must first identify exactly where the kinetochore will be formed.

To gain a deeper understanding of this mechanism, the scientists combined various modern methods of molecular biology. They modified individual regions of the βKNL2 protein and observed how these changes affected the protein's position within the cell. Using fluorescent labels, they were able to visualise, under the microscope, whether the βKNL2 protein continued to reach the centromere or accumulated in the wrong places within the cell.

"Our findings show that βKNL2 does not occur at the centromere by chance. The protein has specialised regions that guide it precisely to the location where the kinetochore needs to be assembled," Ramakrishna Yadala, the study's first author, explained.

The research team discovered that two regions of βKNL2 are particularly important in enabling the protein to reach its target site: the so-called SANTA domain and several sections at the C-terminus of the protein, the end of the protein chain. A domain is a region of a protein with a specific function. For example, the SANTA domain helps βKNL2 localise to the correct position within the cell. When these regions were removed or altered, βKNL2 could no longer reliably reach the centromere.

But that's not all: "We were also able to show that βKNL2 does not act alone. It recognises the centromere DNA and forms bonds with other molecular partners. It is this interaction

that enables the formation of the structures which are later necessary for error-free chromosome segregation," Ramakrishna Yadala explained. In particular, a region at the end of βKNL2, known as motif III, plays an important role in DNA binding. The closely related protein, αKNL2, in turn, helps to position βKNL2 correctly and, together with it, forms a functional complex.

Using AI tools, the IPK research team was also able to model the spatial arrangement of the proteins involved, thereby gaining a more profound understanding of their interactions. The analyses showed that βKNL2 not only interacts with αKNL2, but can also form a complex with a second βKNL2 unit.

"Ultimately, our work provides a new insight into how the building blocks of the kinetochore organise themselves," says Dr. Inna Lermontova, head of the 'Kinetochore Biology' research group at the IPK. "βKNL2 therefore acts not only as a guide to the centromere, but also as an active component of a molecular scaffold that supports the assembly of this vital structure."

Original publication:

Yadala *et al.* (2026): Structural Basis of βKNL2 Centromeric Targeting Mechanism and Its Role in Plant-Specific Kinetochore Assembly. Nucelic Acids Research.
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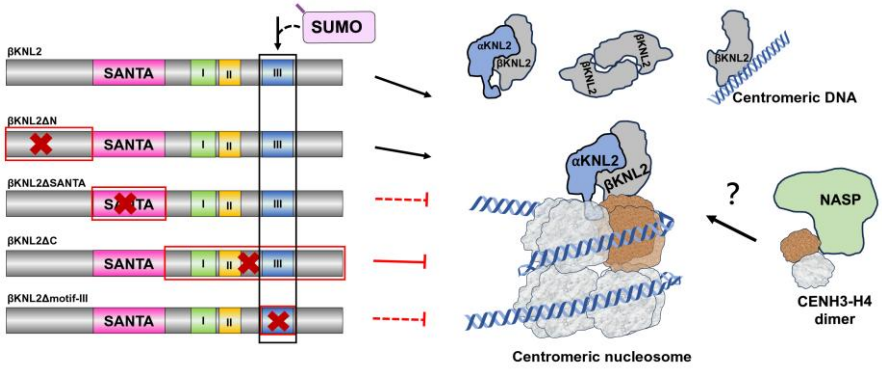
Graphic:



The graphic shows how the plant-specific protein βKNL2 finds its target site at the centromere. Various regions of the protein play a crucial role in this process: they enable binding to DNA and other proteins, thereby creating the conditions necessary for the formation of the kinetochore - a structure that ensures the correct distribution of chromosomes during cell division.