Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)
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Key and lock: IPK research team clarifies how important proteins ‘dock’ to the centromere

Press Release

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Gatersleben, 07.01.2025 **The centromere of chromosomes plays a crucial role in cell division. Using the model plant Arabidopsis thaliana, an international team of researchers led by the Leibniz Institute IPK has investigated how two crucial proteins - KNL2 and CENP-C - dock to the centromere — components which play a central role in this process. The results were published in the journal “Nucleic Acids Research”.**

During mitotic and meiotic cell division, the spindle fibres bind the chromosomes via a special region, the so-called centromere, and pull the sister chromatids apart so that each daughter cell receives the same genetic material. The centromere consists of centromeric DNA and a multiprotein complex, the kinetochore. The kinetochore ensures the correct distribution of chromosomes between the two daughter cells and, thus, the stability of the genome, as well as the proper function of genes in eukaryotic organisms.

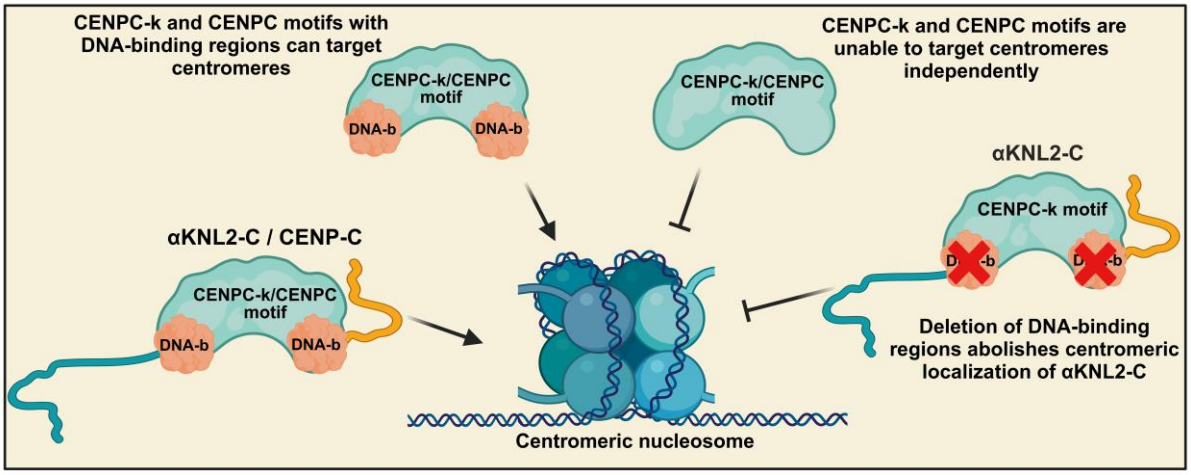
The two proteins, KNL2 and CENP-C, are crucial for correctly separating chromosomes during cell division. They dock precisely onto the centromeric DNA, analogous to the “lock and key principle”. However, already-known sections of the two proteins, so-called CENPC-k/CENPC motifs, are insufficient to establish a connection to the centromere. In a first step, they can only recognise the centromere. “Using the model plant *Arabidopsis thaliana*, we have now been able to show that in addition, so-called DNA-binding regions, located next to the already known motifs of the proteins, are needed”, explains Dr. Inna Lermontova, head of IPK’s research group “Kinetochore Biology”. “These binding regions are essential for a connection with the centromere and thus for the interaction of the proteins with the centromeric DNA”, says Surya Prakash Yalagapati, first author of the study.

“These results deepen our understanding of centromere architecture and open up new possibilities in synthetic biology and chromosome engineering”, says Dr. Inna Lermontova. Fragments with CENPC/CENPC-k motifs and DNA-binding regions can precisely target proteins that alter centromere chromatin structure to centromeres. This study provides new insights into the mechanisms of centromere formation and the function of the kinetochore complex. “In the long term, this approach could advance plant breeding by optimising the production of double-haploid lines and thus accelerating the breeding process”, the IPK researcher says.

Original publication:

Yalagapati *et al.* (2024): Centromeric localization of KNL2 and CENP-C proteins in plants depends on their centromere-targeting domain and DNA-binding regions. Nucleic Acids Research. DOI: 10.1093/nar/gkae1242

Graphic (for free use):



The two proteins KNL2 and CENP-C are crucial for the correct separation of chromosomes during cell division. To dock to the centromere, the newly described additional binding regions (DNA-b) to the previously known CENPC-k/CENPC motifs are required (this image was created using BioRender.com).