BDR SEMINAR in Kobe

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14:00-15:00, 7F Seminar Room, DB Building A

Molecular dynamics and multiple feedback loops play critical roles in centriole duplication

Summary

Centrioles are duplicated once in every cell cycle to produce a single copy of each pre-existing centriole. This strict regulation of the centriole copy number ensures the bipolarity of the mitotic spindle. Although the core components have been identified, how they cooperate to achieve high fidelity in centriole duplication remains poorly understood. At the onset of centriole duplication, the master regulator Polo-like kinase 4 (Plk4) undergoes a dynamic change in its spatial pattern around the pre-existing centriole, forming a single duplication site. However, the significance and mechanisms of this pattern transition remain unknown. Using STED super-resolution imaging, we found that centriolar Plk4 exhibits periodic discrete patterns resembling pearl necklaces, frequently with single prominent foci. Mathematical modeling and simulations incorporating the self-organization properties of Plk4 successfully generated the experimentally observed patterns. We therefore propose that the self-patterning of Plk4 is crucial for the regulation of centriole duplication. These results, defining the mechanisms of self-organized regulation, provide a fundamental principle for understanding centriole duplication.

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