NUS National University of Singapore | Department of Biological Sciences
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VIRTUAL BIOLOGY COLLOQUIUM

Friday, 31 Mar 2023 | 4 pm | Online Zoom Session

Hosted by Asst. Prof Xue Shifeng

Molecular mechanism of DNA loop extrusion by the condensin complex

By **Je-Kyung Ryu**
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In each human cell, 2 meter DNA is compacted into chromosomes that are packed into a micrometer-sized nucleus, but the mechanism by which the extremely long and negatively charged polymer is compacted into this tiny structure remains elusive. Structural Maintenance of Chromosome (SMC) protein complexes such as cohesin and condensin are the key organizers of the spatiotemporal structure of chromosomes by extruding DNA loops. However, the molecular mechanism of how such SMC motor proteins extrude DNA loops remains completely unknown. In our work using liquid-phase High-Speed Atomic Force Microscopy (HS AFM) and magnetic tweezers (MT), we were the first to obtain experimental data for yeast condensin acting on individual DNA molecules. The findings suggest a scrunching model in which the SMC complex extrudes a DNA loop by a cyclic switching of its conformation between open and collapsed shapes. Our findings are indicative of a type of scrunching model in which condensin extrudes DNA by a cyclic switching of its conformation between the open and collapsed shapes.

About the Speaker

Je-Kyung Ryu is an assistant professor at the Seoul National University in South Korea for biophysics from March 2022. He is working for structural dynamics of chromosome organizing proteins using High-Speed Atomic Force Microscopy (HS AFM) and various single-molecule assays.

His recent scientific accomplishments with colleagues are as follows.
2020: He showed that condensin holocomplex extrudes a DNA loop using conformational changes between open and collapsed states using HS AFM (NSMB (2020), 27(12), 1134-1141).

2021: He showed that cohesin complex can phase separate along a DNA and discovered that this is a new type of phase separation, called bridging-induced phase separation (Science Advances (2021), 7(7), eabe5905).
2022: He showed the exact step size of condensin-mediated DNA loop extrusion using magnetic tweezers and showed that ATP binding in condensin is the force-generating step for DNA loop extrusion (NAR (2022), 50(2), 820-832.)

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