Probing the physical and biological properties of chromatin by magnetic micro-manipulation

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Abstract :

The organization and dynamics of chromosomes in 4D inside the cell nucleus are central for understanding how the genome works. However, fundamental questions about the physical state of chromosomes remain open. Our lab have recently developed a new technology to mechanically micro-manipulate chromosomes inside living cells by exerting a point force onto a targeted chromosomal locus using magnetic nanoparticles, allowing us to probe the physical properties of chromatin from a new perspective.

Our first study outlined that interphase chromatin is a surprisingly fluide-like material. Specifically, the response to a point force is well captured by a simple Rouse polymer model, which ignores volume exclusion, affinities, crosslinks and topological effects.

Our micromanipulation approach opens many avenues for future research, to study the material state of chromatin in relation to its biological state, especially the effect of chromosomes conformation on gene expression, and the impact of biological processes such as transcription condensates or estrogen receptor alpha (ERα) on the physical state of chromatin.