Probing phase transitions of DNA-protein condensates using single molecule localization microscopy

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Outline

- Introduction: biological motivation and broad overview of microscopy approaches, IDRs of BRD4/MED1
- Methods: High-throughput and super-resolution imaging, PSF engineering, dSTORM chemistry, photoswitching dynamics
- Methods: Motivation for deep learning methods for 3D imaging at high density
- Methods: Bayesian clustering algorithms on high density data
- Results: Induction of gene expression, colocalization with phase separation markers
- Results: Statistics of nucleosome organization in phase separated clusters

A phase separation model for transcriptional control

IDRs of BRD4/MED1

The role of nucleosome organization in phase separation of DNA-protein condensates

HaloTag labeling method

Single molecule localization microscopy for super-resolution

Direct stochastic optical reconstruction microscopy Fourier shell correlation

Statistics of sCMOS cameras

Point spread function engineering for three-dimensional imaging

Localization microscopy as statistical inference

Localization microscopy as statistical inference

Photoswitching dynamics are a major determinant of localization precision

A deep learning framework for localization microscopy

Deep learning performs better than maximum likelihood estimators

A deep learning framework for localization microscopy

Bayesian clustering algorithms on high density data

Bayesian nonparametrics in general

Bayesian clustering algorithms on high density data

Bayesian nonparametrics

Inducing GBP5 gene expression with Inteferon-γ

Colocalization of nascent GBP5 mRNA with phase separation markers

Costaining of H2B/BRD4/MED1 in interphase Hela cells

Cluster analysis of H2B at putative transcriptional condensates

Physical cluster analysis of H2B at putative transcriptional condensates