Measuring inter-nucleosome interactions and the roles of histone tails

STEVEN HOWELL, George Washington University, KURT ANDRESEN, Gettysburg College, ISABEL JIMENEZ-USECHE, CHONGLI YUAN, Purdue University, XIANGYUN QIU, George Washington University — Nucleosome is the first level of genome organization and regulation in eukaryotes, where negatively charged DNA is wrapped around positively charged histone proteins. Being a DNA-protein complex of biological origin, nucleosome is also a model multi-phasic nanoparticle with heterogeneous charge distributions and brush-like flexible tails of the histone proteins. In solutions of nucleosomes, electrostatic forces dominate inter-nucleosome interactions at long range while specific contacts, in particular the flexible histone tails, guides short range interactions. We have thus quantified how the ions from salts (KCl, MgCl$_2$) modulate the inter-nucleosome pair potential by modeling the total small angle x-ray scattering profiles. We additionally elucidated the individual role of the charged tails of histones H3 and H4. We found that measured effective changes at low salt concentrations are about 1/5th of theoretically predicted renormalized charges and that H4 tail deletion suppresses the attraction at high salt concentrations to a larger extent than H3 tail deletion.