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Abstract for an Invited Paper
for the MAR16 Meeting of
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Micromechanical study of protein-DNA interactions and chromosomes[1]

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I will discuss micromechanics experiments that our group has used to analyze protein-DNA interactions and chromosome organization. In single-DNA experiments we have found that a feature of protein-DNA complexes is that their dissociation rates can depend strikingly on bulk solution concentrations of other proteins and DNA segments; I will describe experiments which demonstrate this effect, which can involve tens-fold changes in off-rates with submicromolar changes in solution concentrations. Second, I will discuss experiments aimed at analyzing large-scale human chromosome structure; we isolate metaphase chromosomes, which in their native form behave as remarkably elastic networks of chromatin. Exposure to DNA-cutting restriction enzymes completely eliminates this elasticity, indicating that there is not a mechanically contiguous protein "scaffold" from which the chromosome gains its stability. I will show results of siRNA experiments indicating that depletion of condensin proteins leads to destabilization of chromosome mechanics, indicating condensin's role as the major chromatin "cross-linker" in metaphase chromosomes. Finally I will discuss similar experiments on human G1 nuclei, where we use genetic and chemical modifications to separate the contributions of the nuclear lamina and chromatin to the mechanical stiffness of the nucleus as a whole.

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[2]I'd like to present my talk from my laptop (movies)