A MECHANISM FOR ATP-DEPENDENT NUCLEOSOME SPACING BY THE CHROMATIN REMODELING COMPLEX ACF

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Chromatin structure regulates the accessibility of DNA in several crucial nuclear processes, including transcription, replication and recombination. The chromatin-remodeling complex ACF translationally repositions histone octamers on DNA and facilitates formation of repressive chromatin by generating equal DNA spacing between nucleosomes. To dissect ACF mechanism, we used a FRET based approach to follow the movement of DNA with respect to the histone octamer in real time. We found that ACF generates at least one transient intermediate in which part of the DNA has moved across the histone octamer. Furthermore, we found that ACF acts as a DNA length sensor. ACF activity progressively slows down as the extranucleosomal DNA shortens below 60 bp. This generates a dynamic equilibrium in which centrally located nucleosomes accumulate but are constantly exchanged with off-center positions. Our results provide a mechanism for the spacing activity of ACF and imply that ACF acts locally to generate long-range changes in chromatin structure.