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Electric Field Destabilizes Noncovalent Protein-DNA Complexes.

Musheev MU, Filiptsev Y, Okhonin V, Krylov SN

J Am Chem Soc 2010 Sep 10 [abstract on PubMed] [citations on Google Scholar] [related articles] [full text]

Selected by | Scott K Silverman
Evaluated 17 Sep 2010
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Faculty Member

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Structural Biology

Hypothesis
New Finding
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Comments

The authors report experimental data showing that electric fields with magnitudes relevant to both in vitro and in vivo situations can impact the dissociation of protein-DNA complexes. This work is interesting because it provides direct experimental evidence for a chemically meaningful influence of electric fields on protein-DNA interactions.

Using a capillary electrophoresis technique, the authors determined k-off (i.e. the rate constant for protein-DNA complex dissociation) for the MutS protein and a corresponding DNA aptamer. They found that k-off increased by 7-fold when the electric field was increased from 0 to 600V/cm. They also presented evidence that various non-electric field effects, such as temperature changes and capillary wall effects, are not responsible for the observations. For routine in vitro work, such as nondenaturing polyacrylamide gel electrophoresis, the electric field magnitudes (e.g. on the order of 10V/cm in experiments that are performed in my own lab and others like it) are apparently too small to have much of an effect on protein-DNA interactions, according to the authors' data. However, for other in vitro work such as that performed using various capillary electrophoresis techniques, the electric fields may be large enough to influence protein-DNA interactions. Regarding in vivo interactions, the electric fields near membranes are described to be much larger (by several orders of magnitude) than the electric fields studied here by the authors, suggesting that the effects of in vivo electric fields on protein-DNA interactions could be considerable.

Competing interests: None declared
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Faculty Comments & Author Responses

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