DOI: 10.1002/open.201400004
Read the full text of the article at 10.1002/open.201400002

Conformational Dynamics of DNA G-Quadruplex in Solution Studied by Kinetic Capillary Electrophoresis Coupled On-line with Mass Spectrometry

The Group of Maxim V. Berezovski

uOttawa
Department of Chemistry
University of Ottawa
10 Marie Curie
Ottawa K1N 6N5 (Canada)
E-mail: maxim.berezovski@uottawa.ca

Invited for this month's cover is the group of Prof. Maxim V. Berezovski. The cover picture shows the two-dimensional separation of unfolded (green) and folded (red) forms of G-quadruplex (GQ) DNA. The first dimension is kinetic capillary electrophoresis (KCE) separation of unfolded and folded DNA with different K^+ concentrations in solution; the second dimension is ion mobility mass spectrometry separation of DNA conformers in the gas phase. DNA folding into a compact GQ structure is mediated by K^+ ions. For more details, see the Full Paper on p. 58 ff.

What is the most significant result of this study?

In this work, we coupled on-line kinetic capillary electrophoresis with mass spectrometry (KCE-MS) to study conformational dynamics of DNA G-quadruplexes in solution. We showed that peak's shift and its widening in KCE can be used for measuring rate and equilibrium constants for DNA–metal affinity interactions and G-quadruplex formation; and ion mobility mass spectrometry (IM-MS) provided information about relative sizes, absolute molecular masses and stoichiometry of DNA complexes.

What was the biggest challenge (on the way to the results presented in this paper)?

The translation of mathematical calculations to visual interpretation.

Did you expect a very different outcome? If so, what was your initial guess?

We did not expect such a big difference in migration time between folded and unfolded DNA. Our initial guess was that we could measure only a thermodynamic folding constant, but not rate constants for the fast conformational change.

What future opportunities do you see (in the light of the results presented in this paper)?

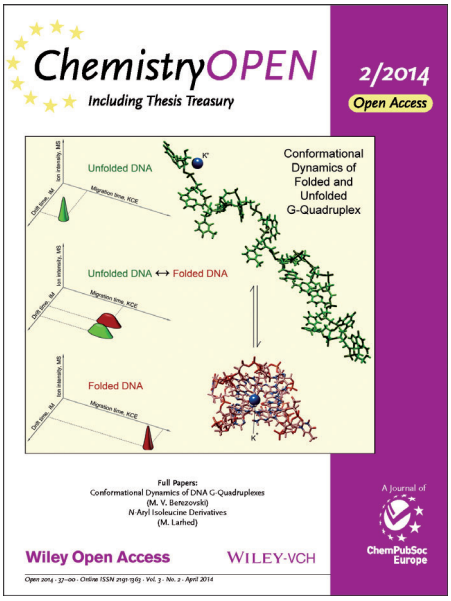
We believe that KCE-MS will be used complementally to CD, SF, and SPR techniques for studying nucleic acid structures and functions, screening DNA/RNA binding compounds and selecting aptamers.

What is in your opinion an upcoming research theme likely to become one of the 'hot topics' in the near future?

Fast conformational dynamics and affinity interactions of big DNA and RNA molecules.

Acknowledgements

This work was supported by the Natural Sciences and Engineering Research Council of Canada (grant RGPIN/385739-2010) and Canada Foundation for Innovation (project no. 25462). The authors also thank Dr. Jeffrey W. Keillor for providing his facilities to perform CD experiments and Mr. Justin Renaud for critical comments and valuable suggestions.



 © 2014 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim