PHYSICO-CHEMICAL PROPERTIES OF DNA IN REGULATORY SITES OF THE GENOME

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The goal of our work is to find common characteristics of DNA region breakage during ultrasound strikes. The analisys of a large number of physical and structural characteristics, averaged over representative sets of the evolutionary divergent species from animals, plants and unicellular fungi were processed. In addition to the characteristics defined at the base-pair steps, we, for the first time, use profiles of the ultrasonic cleavage indexes, informative for internal properties of each complementary strand. Special characteristics of conformational behavior are revealed in metazoans at the region, which connects the end of TATA-box and the transcription start site (TSS). The intensities of conformational motions in the complementary strands are periodically changed in opposite phases. They are noticeable, best of all, in mammals. Obtained results may be useful in genetic engineering for theoretical study of DNA. We studied ultrasonic cleavage rates of methylated and unmethylated dinucleotides in plants, bacterial and Human genomes along with CpG islands in normal and cancer samples (lymphoma and hepatocellular carcinoma). It was shown that methylated CpG dinucleotides and CpG islands have significantly higher cleavage rates than corresponding unmethylated ones. Moreover, cleavage rates of CpG dinucleotides also differ between cancer and normal samples. Last observation, potentially, could be used in cancer diagnostics in a future.

References:

1. Grokhovsky S.L. et al Biophysics 2008, 53, 417-425.
2. Nechipurenko Yu.D. et al J. Strukt. Khimii 2009, 50, 1040-1047.
3. Sergei L. Grokhovsky, Irina A. Il'icheva, Dmitry Yu. Nechipurenko, Michail V. Golovkin, Larisa A. Panchenko, Robert V. Polozov and Yury D. Nechipurenko /Biophysical Journal, 2011, Vol.100, N1, P.117-125.
4. Il'icheva I.A., Khodikov M.V., Poptsova M.S., Nechipurenko D.Yu., Nechipurenko Yu.D., Grokhovsky S.L. Structural features of DNA that determine RNA polymerase II core promoter. BMC genomics 17, 973 (2016).