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Pharma Biotech 2018: The centers of premeltons signal the beginning and ends of genes - Henry M Sobell - University of Rochester, USA

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Abstract

Premeltons are examples of emergent structures (i.e., structural solitons) that arise spontaneously in DNA due to the presence of nonlinear excitations in its structure. They are of two kinds: B-B (or A-A) premeltons form at specific DNA-regions to nucleate site-specific DNA melting. These are stationary and, being globally nontopological, undergo breather motions that allow drugs and dyes to intercalate into DNA. B-A (or A-B) premeltons, on the other hand, are mobile, and being globally topological, act as phaseboundaries transforming B- into A-DNA during the structural phase-transition. They are not expected to undergo breather-motions. A key feature of both types of premeltons is the presence of an intermediate structural-form in their central regions (proposed as being a transition-state intermediate in DNA-melting and in the B- to A-transition), which differs from either A- or B-DNA. called Beta- DNA, this is both metastable and hyperflexible and contains an alternating sugar-puckering pattern along the polymer-backbone combined with the partial-unstacking (in its lower energy-forms) of every other base pair. Beta-DNA is connected to either B- or to A-DNA on either side by boundaries possessing a gradation of nonlinear structural-change, these being called the kink and the anti-kink regions. The presence of premeltons in DNA leads to a unifying theory to understand much of DNA physical-chemistry and molecular-biology. In particular, premeltons are predicted to define the 5??? and 3??? ends of genes in naked-DNA and DNA in active chromatin, this having important implications for understanding physical aspects of the initiation, elongation and termination of RNA-synthesis during transcription. For these and other reasons, the model will be of broader interest to the general audience working in these areas. The model explains a wide variety of data, and carries within it a number of experimental predictions all readily testable as will be described in the presentation. Recent Publications 1. Sobell H M (2016) Premeltons in DNA. Journal of Structural and Functional Genomics 17(1):17-31. 2. Sobell H M (2009) Premeltons in DNA. A Unifying Polymer Physics Concept to Understand DNA Physical Chemistry and Molecular-Biology. Explanatory Publications ISBN-978-0-615-33828-6. 3. Sobell H M (2013) Organization of DNA in Chromatin. Rather than bending uniformly along its length, nucleosomal DNA is proposed to consist of multiple segments of B- and A- DNA held together by kinks when forming its left-handed toroidal superhelical structure. Explanatory Publications ISBN-978-0-692-01974-0.

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