# Superstatistical model of bacterial DNA architecture

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## Abstract

© The Author(s) 2017. Understanding the physical principles that govern the complex DNA structural organization as well as its mechanical and thermodynamical properties is essential for the advancement in both life sciences and genetic engineering. Recently we have discovered that the complex DNA organization is explicitly reflected in the arrangement of nucleotides depicted by the universal power law tailed internucleotide interval distribution that is valid for complete genomes of various prokaryotic and eukaryotic organisms. Here we suggest a superstatistical model that represents a long DNA molecule by a series of consecutive ~150 bp DNA segments with the alternation of the local nucleotide composition between segments exhibiting long-range correlations. We show that the superstatistical model and the corresponding DNA generation algorithm explicitly reproduce the laws governing the empirical nucleotide arrangement properties of the DNA sequences for various global GC contents and optimal living temperatures. Finally, we discuss the relevance of our model in terms of the DNA mechanical properties. As an outlook, we focus on finding the DNA sequences that encode a given protein while simultaneously reproducing the nucleotide arrangement laws observed from empirical genomes, that may be of interest in the optimization of genetic engineering of long DNA molecules.

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