

Binding of Transcription Factors to Non-Regulatory DNA: The Gaussian Genome

Rumen N. Georgiev¹, Jasper Landman¹ and Willem K. Kegel¹

¹*van't Hoff Laboratory for Physical and Colloid Chemistry, Utrecht University, Utrecht, The Netherlands*

Recent studies in biophysics suggest transcription factor interactions with non-regulatory DNA are sequence-dependent and vary along the DNA strand [1]. This makes numerical calculation of the grand canonical partition function [2] cumbersome and renders predictions of genetic activity a seemingly insurmountable task. Using the cumulant-generating function of the normal distribution, we derive the partition function and define an effective energy, a single quantity which accounts for the contributions from the whole spectrum of binding energies. Applying our approach to the *lac* repressor and RNAP, two prominent *lac* operon transcription proteins, we obtain theoretical results which are in good accord with the actual biophysical picture.

[1]M. Lässig, BMC Bioinformatics 8(Suppl 6), S7 (2007).

[2]F. M. Weinert et al, PRL 113, 258101 (2014)