Applied Mathematics

McGill Applied Mathematics Seminar

April 3, 2007, Tuesday

At McGill, Burnside Hall 1214

"A Multi-scale Mathematical Model for Combinatorial Control of DNA Transcription"

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Coffee and refreshments will be served after the seminar

Abstract: Many research works on gene expression support the fact that DNA transcription is a complex process controlled by transcription factors (proteins) and the corresponding DNA regulatory elements (binding sites). Most existing mathematical models for gene regulatory networks focus on transcription factors only and either treat the DNA structures as black boxes or consider only one or two factors at the DNA level. We propose a 3-scale mathematical model which consists of computer simulation of transcription factor (TF) activity, mathematical description of cis regulatory elements (RE) along the DNA chain and integration of TF and RE to predict transcription output. Our modeling at the DNA level will integrate all the key factors on the binding sites including arrangement, spacing, stoichiometry, affinity and collaboration. Computation accuracy and efficiency are also important issues for this kind of modeling because many existing models are large and complex systems. We propose to use an equation-free approach to capture the main characteristics of TF with high accuracy and efficiency.