INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Programme of Study	:	PhD

Thesis Title: **NOISE ACTIVATED DYNAMICS OF DNA THROUGH NANOPOROUS GEL**

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SHORT ABSTRACT

Gel electrophoresis is a widely used protocol in molecular biology and biochemistry for separating and analyzing biomolecules based on their size, charge or other physical properties. However, conventional gel electrophoresis techniques suffer from limitations such as time-consuming process and the need for specialized equipments. In Chapter 2 of this dissertation, we have demonstrated noise activated gel electrophoresis, a phenomenon in which the addition of noise in the form of voltage pulses combined with bias voltage can improve the separation efficiency and sensitivity of gel electrophoresis. We also have discussed the theoretical foundations of modified Langevin equation supporting our experimental results. Noise activated gel electrophoresis offers the potential for reducing the reliance on high voltages and extended separation times, making it a promising alternative for rapid and efficient biomolecule analysis. Furthermore, the integration of noise assisted gel electrophoresis with other analytical techniques holds the potential for developing novel approaches in genomics, proteomics and clinical diagnostics. With ongoing research and advancements noise activated gel electrophoresis is poised to revolutionize the field of bio-molecular separations and analysis enabling faster characterization of biological samples. In Chapter 3 of this dissertation, experimental analysis explained that noise applied in a direction orthogonal to the bias direction, it is feasible that the macromolecule will choose the path that uses least amount of energy in the energy landscape. Instead of immediately crossing the barrier's apex, the molecule might seek for the neighbourhood's lowest barrier height and use the least energy-consuming route to avoid the energy loss incurred by the apex-crossing. In Chapter 4, we explored how, in an electrophoretic environment, the adhesive engagement of a soft deformable macromolecule within the gel matrix leads to a sub-critical rupture generating faster translocation due to the existence of asymmetric vibration in the form of ramp pulses. Chapter 5 illustrated how, utilizing an external noise assisted gel electrophoretic platform, Aptamer-AuNP band mobility can be increased, allowing biologists to detect particular pathogens quickly for correct antibiotic prescription and additional counseling. This study also aimed to develop an aptasensor based on the surface plasmon resonance (SPR) of gold nanoparticles that generates a straightforward colorimetric output.