Theoretical approaches for DNA dynamics rely on a combination of simulations, continuum modeling and scaling approaches.

This is explained with a few recent examples:

The dynamics of DNA sections is scale dependent and exhibits elastic effects, entropic effects and center-of-mass dynamics as one goes from smaller to larger scales, with measurable consequences for the binding rate of peptides to DNA. In modern single-molecule studies of protein unfolding DNA functions as force-transducer. Extracting protein folding landscapes and transition rates requires deconvolution of the experimental data and thus knowledge of the dynamic response of DNA chains. A DNA polymer that is continuously rotated at one end exhibits a critical rotational frequency, at which the dominant hydrodynamic dissipation mode changes from speedometer-cable-like axial spinning to a loop creation/diffusion mode. This is relevant for in-vivo DNA replication and transcription processes.