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Mapping the phase diagram of DNA force-induced melting in the presence of DNA intercalators IOANA VLADESCU, MICAH MCCAULEY, Department of Physics, Northeastern University, MEGAN NUNEZ, Department of Chemistry, Mount Holyoke College, IOULIA ROUZINA, Department of Biochemistry Molecular Biology and Biophysics, University of Minnesota, MARK WILLIAMS, Department of Physics, Northeastern University — The interactions between single DNA molecules and different non-covalent binding agents - the classical intercalator ethidium and compounds from the family of ruthenium complexes - are investigated using an optical tweezers instrument and their effects on the structure and mechanical stability of DNA molecules are quantitatively analyzed using a model of force-induced melting. When a single DNA molecule is stretched beyond its normal contour length, a melting phase transition is observed. Drug binding increases the dsDNA contour length, decreases the DNA elongation upon melting, and increases the DNA melting force. At concentrations of intercalator above critical, no force induced melting of dsDNA is possible. The DNA stretching curves map out a phase diagram for DNA melting in the presence of intercalator, and define its critical point in the force-extension-drug concentration space. Our results allow for the complete thermodynamic characterization of the interaction of these intercalators with DNA.

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