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Fluctuation Pressure Assisted Ejection of DNA From Bacteriophage MICHAEL J. HARRISON, Michigan State University — The role of thermal pressure fluctuations excited within tightly packaged DNA while it is ejected from protein capsid shells is discussed in a model calculation. At equilibrium before ejection we assume the DNA is folded many times into a bundle of parallel segments that forms an equilibrium conformation at minimum free energy, which presses tightly against capsid walls. Using a canonical ensemble at temperature T we calculate internal pressure fluctuations against a slowly moving or static capsid mantle for an elastic continuum model of the folded DNA bundle. It is found that fluctuating pressures on the capsid from thermal excitation of longitudinal acoustic vibrations in the bundle whose wavelengths are exceeded by the bend persistence length may have root-mean-square values that are several tens of atmospheres for typically small phage dimensions. Comparisons are given with measured data on three mutants of lambda phage with different base pair lengths and total genome ejection pressures.

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