CORRECTIONS

J. F. Marko* and E. D. Siggia: Bending and Twisting Elasticity of DNA. Volume 27, Number 4, February 14, 1994, pp 981−988.

In a previous paper,[1] we incorrectly discussed cubic nonlinear terms in a model for the elastic free energy of weakly distorted double-helix DNA. At the top of p 983, we state that only A_{111}, A_{123}, A_{133}, and A_{122} are nonzero; in fact, these are the terms which are zero, since they multiply terms which change sign under the symmetry operation $\{\Omega_1,\Omega_2,\Omega_3\} \rightarrow \{-\Omega_1,\Omega_2,\Omega_3\}$. The nonzero elastic constants are those multiplying terms with even powers of Ω_1, namely A_{112}, A_{222}, A_{113}, A_{223}, A_{233}, and A_{333}.

This error is repeated at the bottom of p 985, where the cubic correction of the elastic energy is computed. When the perturbative calculation (evaluation of eq 23 of 1 along the trajectory $\phi(s) = \omega s + \phi(0)$) is followed using the correct cubic terms, the 113, 223, and 333 terms contribute to the free energy at cubic order in κ and $\langle\Omega_3\rangle$. The complete effective elastic energy (eq 22 of ref 1) including these terms is

$$\frac{F}{kT} = \frac{1}{2}\int ds \left\{\left(A - \frac{D^2}{2C}\right)\kappa^2 + C\langle\Omega_3\rangle^2 + \left(\frac{D^2}{C\omega_0} + \frac{1}{2}[A_{113} + A_{223}]\right)\kappa^2\langle\Omega_3\rangle + \frac{1}{3}A_{333}\langle\Omega_3\rangle^3\right\}$$

The final 333 term is simply a consequence of chirality of the double helix: left- and right-handed twists are distinguishable. The 113 and 223 terms combine to generate a coupling between the square of curvature and mean twist which adds to the $D^2/C\omega_0$ contribution. Since the double-helix bending modulus should only change significantly for twists $\langle\Omega_3\rangle \approx \omega_0$), we expect these two terms to be on the same order. However, the signs of the 113 and 223 terms are not a priori determined, in contrast to that of the $D^2/C\omega_0$ term. Therefore, it is possible that the net coefficient of $\kappa^2\langle\Omega_3\rangle$ is negative and that a net overtwisting could result from DNA bending.[2]

References and Notes

(1) Marko, J. F.; Siggia, E. D. *Macromolecules* **1994**, *27*, 981.
(2) Overtwisting in response to a tight bend introduced into a detailed elastic model of DNA has been reported: Levitt, M. *Proc. Natl. Acad. Sci. U.S.A.* **1978**, *75*, 640.

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