

Chakraborty and Shakhnovich Reply: Recently [1], we studied a model for the adsorption of random heteropolymers (RHPs) onto disordered surfaces; viz., Gaussian RHPs where the A segments prefer to adsorb on the A -type surfaces sites to the same extent as the B segments prefer the B -type sites, and the statistical patterns carried by the RHP and the disordered surface are characterized by Gaussian statistics with short-ranged correlations (variance = σ_2^2 and σ_1^2 , respectively). A replica mean field theory calculation predicted a sharp adsorption transition when the statistics of the RHP sequence and surface site distributions are related in a certain way. The transition appears to be first order, the physical origin being the reduction of loop fluctuations due to competing interactions and the quenched sequence distribution. Hwa and Cule [2] (HC) argue that this phenomenon does not occur, and allude to some supporting calculations of their own. We believe that HC's arguments are flawed.

HC argue that because a *special* term in the fourth order correlator is n independent, RHPs with $\langle \theta \rangle = 0$ (and no other explicit homopolymeric term), experience an in-plane homopolymeric potential *as strong as the heteropolymeric potential* (since they take the homopolymeric potential to be proportional to σ_1^2). The multiplicative form of the Hamiltonian used in [1] is generic for RHPs. Thus, HC seem to make the following general statement. *Any problem involving RHPs without explicit homopolymeric terms is subject to a homopolymeric potential which is as strong as the heteropolymeric potential.* This result is difficult to understand on physical grounds. Consider a simpler situation than the problem studied in [1]; viz., a 2-letter RHP with symmetric composition that is confined to a 2D plane and interacts with a point potential that attracts one type of segment with exactly the same strength as it repels the other type of segment. (More precisely, the Mayer functions have equal magnitude and opposite signs.) HC's argument for the generation of a homopolymeric potential applies to this case also as it is general for arbitrary forms of $\mathbf{k}(\mathbf{r})$. HC would, therefore, predict localization on a microscopic scale. This result is in clear contradiction with analytical and numerical results for this problem [3] and physical intuition.

Further, because of the multiplicative form of the potential in [1], only two types of nonvanishing terms are generated for the fourth order correlator considered by HC. On the other hand, HC's assumed homopolymeric potential generates four types of terms for the fourth order correlator. Thus, HC's potential and the potential used in [1] are not equivalent.

HC construct an Imry-Ma type argument assuming a strong in-plane homopolymeric term, and predict localization on scale 1 in the plane. This is obviously true, and well known (e.g., [4–6]). However, as applied to our problem, this conclusion is a manifestation of HC's physically groundless assumption that there exists a strong in-plane homopolymeric potential. The only physical source

of such a potential is fluctuations causing an imbalance in the number of RHP segments and surface sites of types A and B . For the RHP, this imbalance scales as $1/\sqrt{N}$ per segment. Including this consideration, HC's argument predicts localization on unphysically long length scales.

HC assert that our problem is equivalent to the directed polymer in random media in $2 + 1$ dimensions (DPRM2 + 1). This may be so for large values of $\sigma_1\sigma_2$ when the polymer lies flat on the surface. In our problem, as $\sigma_1\sigma_2$ decreases, chain segments can form loops in a third dimension. Loop entropy plays a crucial role in polymer adsorption (e.g., [3,7,8]). It is difficult to imagine that for such a system the fixed point is the same for all finite $\sigma_1\sigma_2$, and it is that of the DPRM2 + 1. It has certainly not been established.

HC's arguments do not appear to be pertinent to the problem that we have studied. Meanwhile, we have carried out extensive Monte Carlo simulations for chains that are much longer (32, 64, and 128 segments long) than the crossover length predicted by HC (~ 1). We find [8] all the qualitative features reported in [1]. We have also studied RHPs with correlated sequence fluctuations near surfaces bearing sites that are also distributed with fluctuations that exhibit specific types of statistical patterns. Significantly, we find [8] that surfaces bearing a particular statistical pattern can discriminate between RHPs bearing different patterns (recognition).

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Arup K. Chakraborty

Department of Chemical Engineering
and Department of Chemistry
University of California, Berkeley, California 94720

E. I. Shakhnovich

Department of Chemistry and Chemical Biology
Harvard University, Cambridge, Massachusetts 02138

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