The Speed Limit of Protein Folding: Alpha-Helix Initiation Modeled and Observed

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of Technology — As a primary event of protein folding, alpha-helix initiation is
the starting point of macromolecular complexity. In this work, an analytic coarse-
grained model which predicts the initiation rate as a function of temperature, is
presented. Helix initiation was measured via ultrafast temperature-jump fluores-
cence refolding experiments on two penta-peptides, and the measured rates agreed
well with those of the model. In addition, the temporal separation of rate-limiting
diffusion from fast annealing stipulated by the model was confirmed via ensemble-
converging all-atom molecular dynamics simulations, which reproduced both the
diffusion and the picosecond annealing processes and rates observed experimentally.
Some of these results were published in: Mohammed OF, Jas GS, Lin MM, Ma H,
Zewail AH (2009) Primary peptide folding dynamics observed with ultrafast tem-

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