End-monomer dynamics in semiflexible polymers MICHAEL
HINCZEWSKI, XAVER SCHLAGBERGER, Physics Dept., Tech. Univ. of Mu-
nich, MICHAEL RUBINSTEIN, Dept. of Chemistry, Univ. of North Carolina,
OLEG KRICHEVSKY, Physics Dept., Ben-Gurion Univ., ROLAND NETZ, Physics
Dept., Tech. Univ. of Munich — Precise experimental observations over the last
few years of end-monomer dynamics in the diffusion of double-stranded DNA have
given conflicting results: one study indicated an unexpected Rouse-like scaling of
the mean squared displacement (MSD) $\langle r^2(t) \rangle \sim t^{1/2}$ at intermediate times, cor-
responding to fluctuations at length scales larger than the persistence length but
smaller than the coil size; another study claimed the more conventional Zimm scal-
ing $\langle r^2(t) \rangle \sim t^{2/3}$ in the same time range. Spurred by this experimental contro-
versy, we investigate the end-monomer dynamics of semiflexible polymers through
Brownian hydrodynamic simulations, an improved dynamic mean-field theory, and
a heuristic scaling argument [1]. Both theory and simulation point to a novel inter-
mediate dynamical regime where the effective local exponent of the end-monomer
MSD, $\alpha(t) = d \log \langle r^2(t) \rangle / d \log t$, drops below the Zimm value of 2/3 for sufficiently
long chains. This deviation increases with chain length (though it does not reach
the Rouse limit of 1/2), and is related to hydrodynamic effects in the slow crossover
from dynamics on length scales smaller than the persistence length to dynamics on
larger scales. [1] arXiv:0809.0667v1, Macromolecules *in press* (2008).

Michael Hinczewski
Physics Dept., Tech. Univ. of Munich

Date submitted: 21 Nov 2008   Electronic form version 1.4