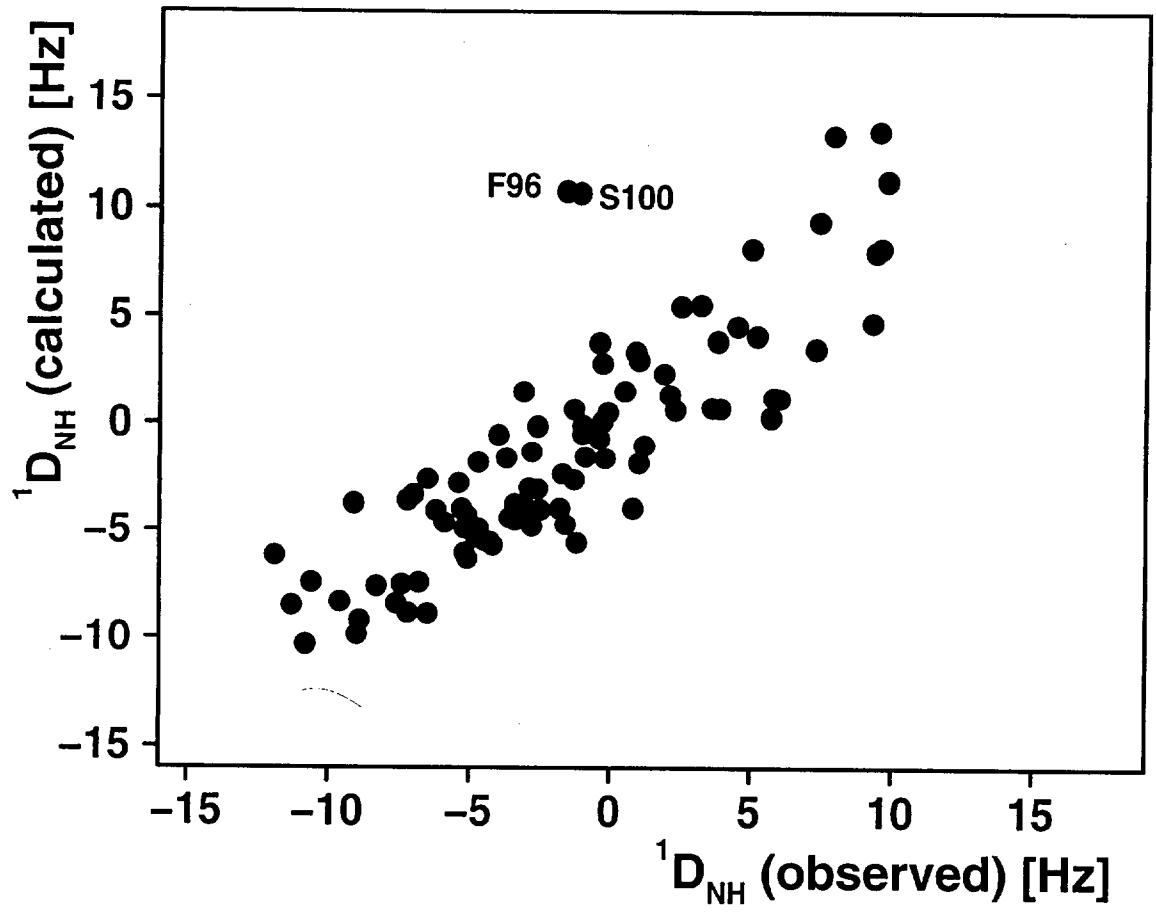
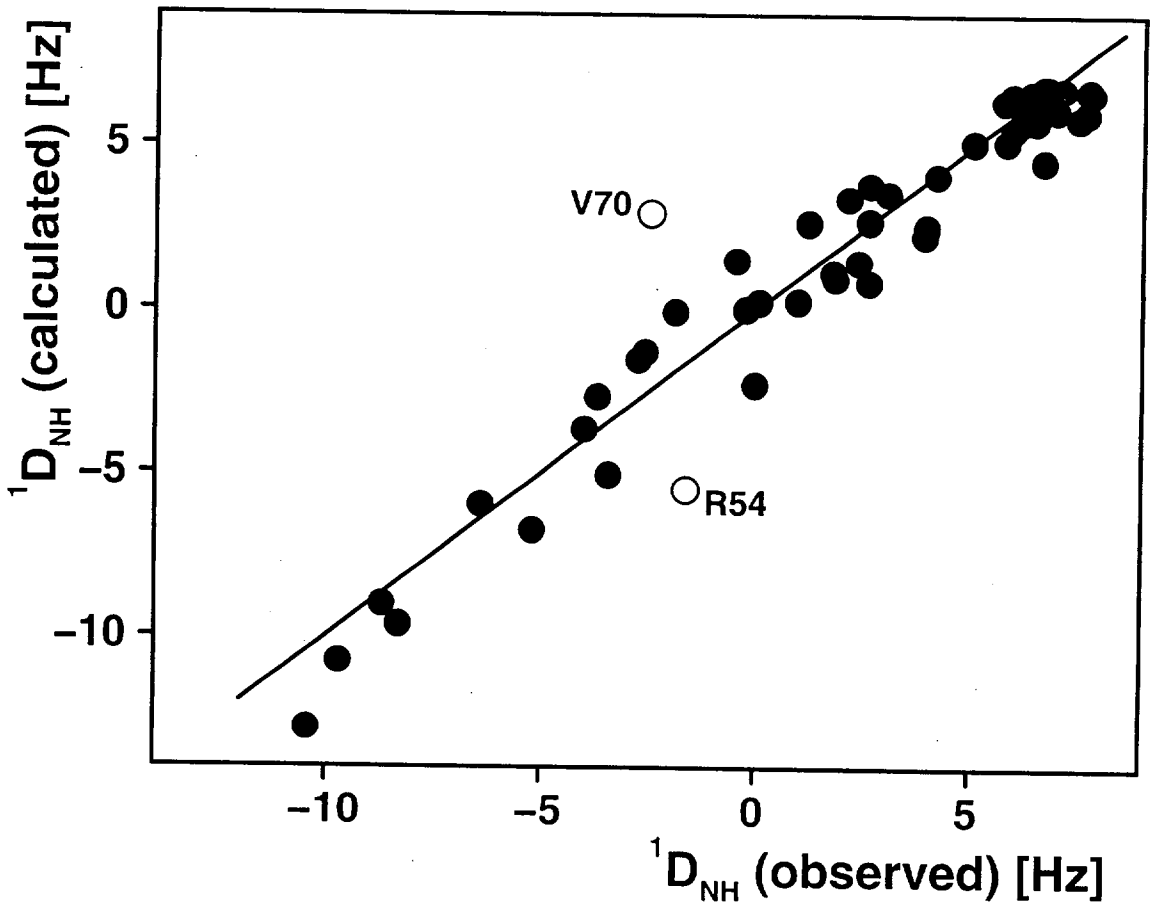
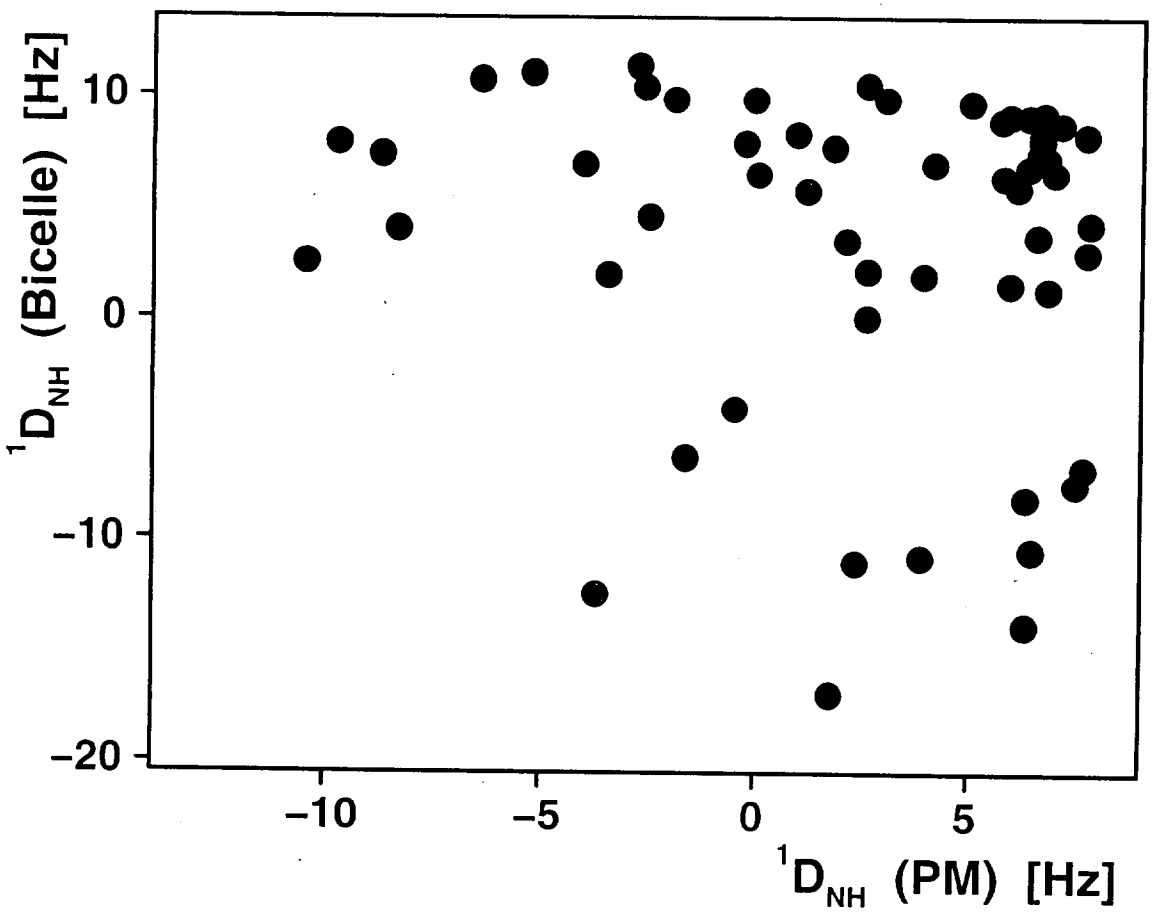


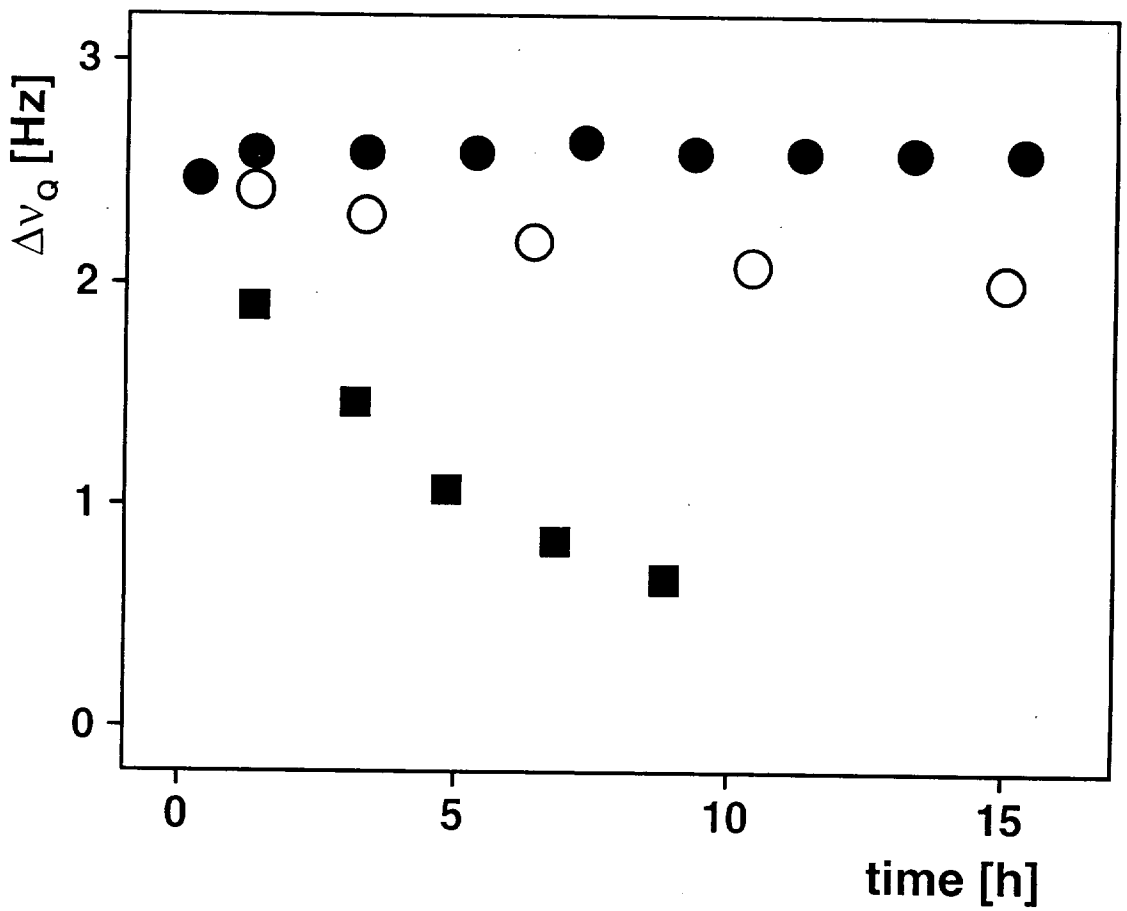
Supporting Information Figure 1. Plot of $^1D_{NH}$ couplings measured for the Vα domain of the human T-cell receptor in 3mg PM/ml, 100 mM NaCl, 25 °C, *versus* values predicted on the basis of a preliminary, medium resolution NMR structure, calculated on the basis of 1931 NOEs and 317 torsion angle restraints. Omitting the two outlying correlations for residues F96 and S100, both in rapid exchange with solvent and located in a flexible loop region, the correlation coefficient, *R*, is 0.90. Again omitting F96 and S100, the quality factor, *Q*, defined analogous to that in ref.10, is 44%.



Supporting Information Figure 2. ^{15}N-^1H one-bond dipolar couplings, $^1D_{NH}$, measured for 57 backbone amides in U-^{15}N ubiquitin in 1 mg/ml PM, 50 mM NaCl, at 600 MHz, *versus* values calculated for the crystal structure,[11] using D_a = -6.46; R = 0.04; α=57°; β=130°; γ = 31°, where α, β, and γ are the Euler angles describing the orientation of the alignment tensor relative to the frame of the PDB ubiquitin coordinates.[11] Residues from the flexible C-terminus are not included. Dipolar couplings measured for V70 and R54 differ from those predicted by the crystal structure, but are in good agreement with those predicted by the solution structure (see Figure 2 of main text).



Supporting Information Figure 3. Plot of $^1D_{NH}$ couplings measured for the ubiquitin backbone amides in neutral bicelles (50 mg/ml, q=3) *versus* values measured in the 1 mg/ml PM medium.



Supporting Information Figure 4. Solvent ^2H quadrupole splitting, $\Delta\nu_Q$, for 9 mg/ml PM suspensions in 90% H_2O, 10% D_2O, at 50 mM NaCl, 22 °C. After addition of salt, one sample was continuously left in the 14 T NMR magnet, for 15 h (filled circles). A second sample was briefly (for approximately 5 minutes) in the magnet for each measurement of $\Delta\nu_Q$, but kept outside of the magnetic field for the remainder of the time (filled squares). After 15 h, the ^2H quadrupole splitting was no longer resolvable. Open circles represent the $\Delta\nu_Q$ splitting, after the sample which had been in the magnet for 15 h was kept outside the magnet, except for brief (5 minute) measurements of $\Delta\nu_Q$. When this sample was stirred mechanically after 4 days of storage, the small reduction in $\Delta\nu_Q$ (from 2.5 to 1.6 Hz) was completely reversed, suggesting that this reduction may be caused by precipitation of some of the largest PM fragments, rather than irreversible clumping. We speculate that coplanar, edge-on fusion of aligned PM fragments occurs in the magnetic field at high salt concentrations. This could increase the average fragment size and may be responsible for the very small initial increase in $\Delta\nu_Q$, observed after inserting the high ionic strength PM suspensions into the magnetic field (filled circles). Similar experiments conducted at higher salt concentrations indicate that the decrease in $\Delta\nu_Q$ is strongly accelerated at higher salt concentrations, but can again be halted by exposure to a strong magnetic field.