Supporting information

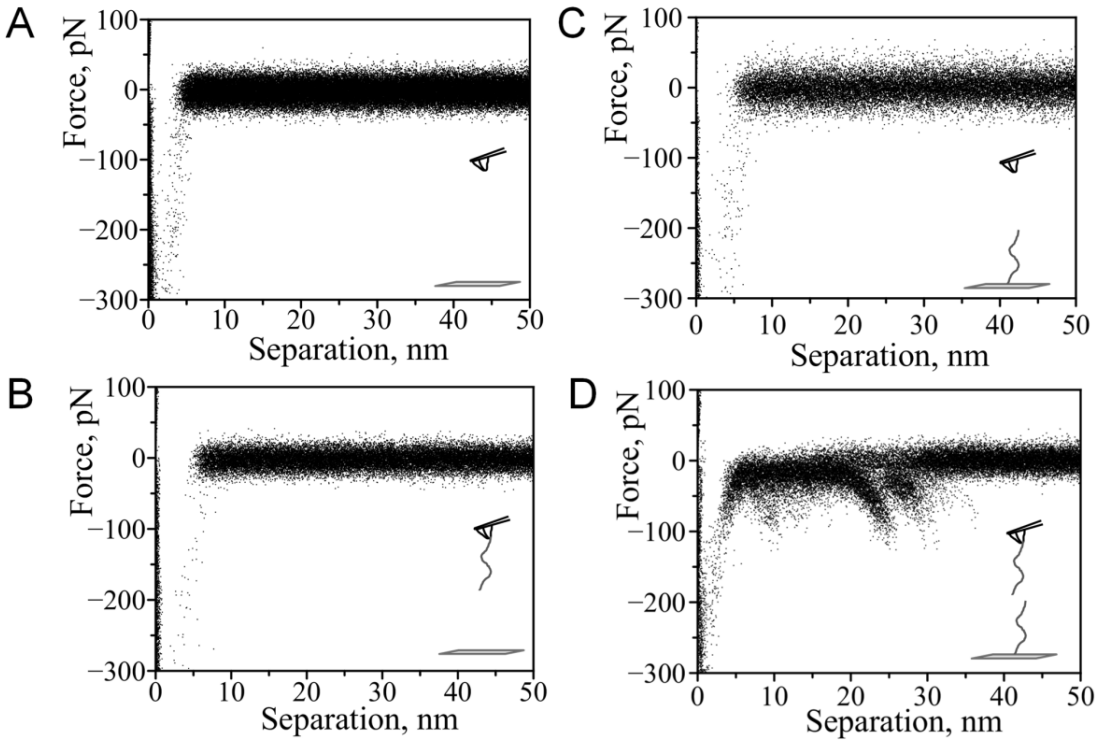


Figure S1. Results of control experiments probing specificity of detected rupture events. Force distance curves measured using tip and surface modified with α-Syn produced rupture events past short range adhesion peak confirming specificity of dimeric interaction (panel D).

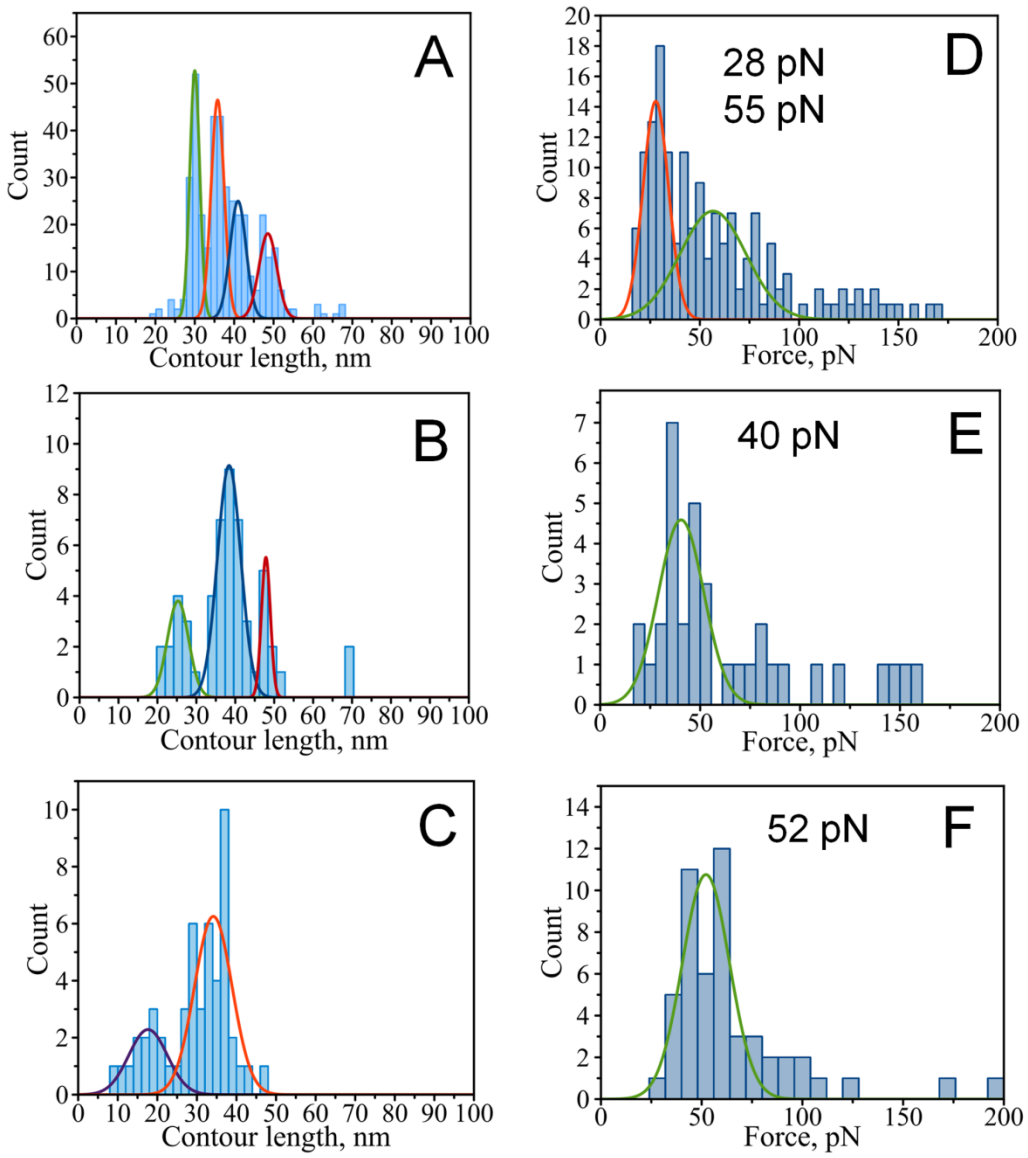


Figure S2. Rupture contour length histograms (A,B,C) and rupture force histograms (D,E,F) for the A30P mutant of α-Syn. A and D) single rupture event group (with contour length maxima at 30±1, 36±2, 41±2 and 49±2 nm and rupture force maxima of 28±6 and 55±17 pN), B and E) last events from multiple rupture group (with contour length maxima at 25±3, 38±3 and 48±1 nm and a maximal rupture force of 40±11 pN, C and F) internal ruptures from multiple rupture group (with contour length maxima at 17±5 and 34±5 nm and a maximal rupture force of 52±12 pN).

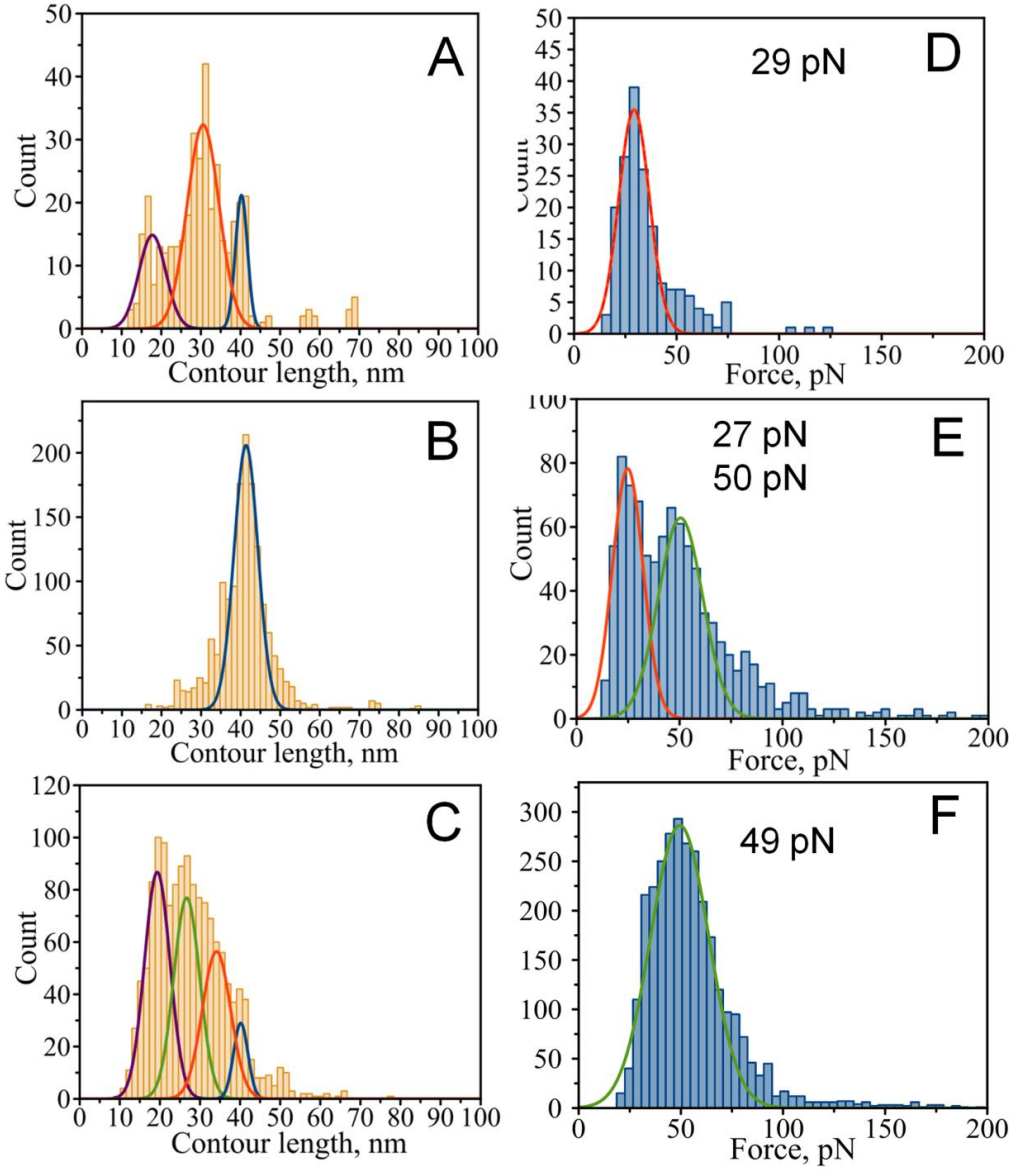
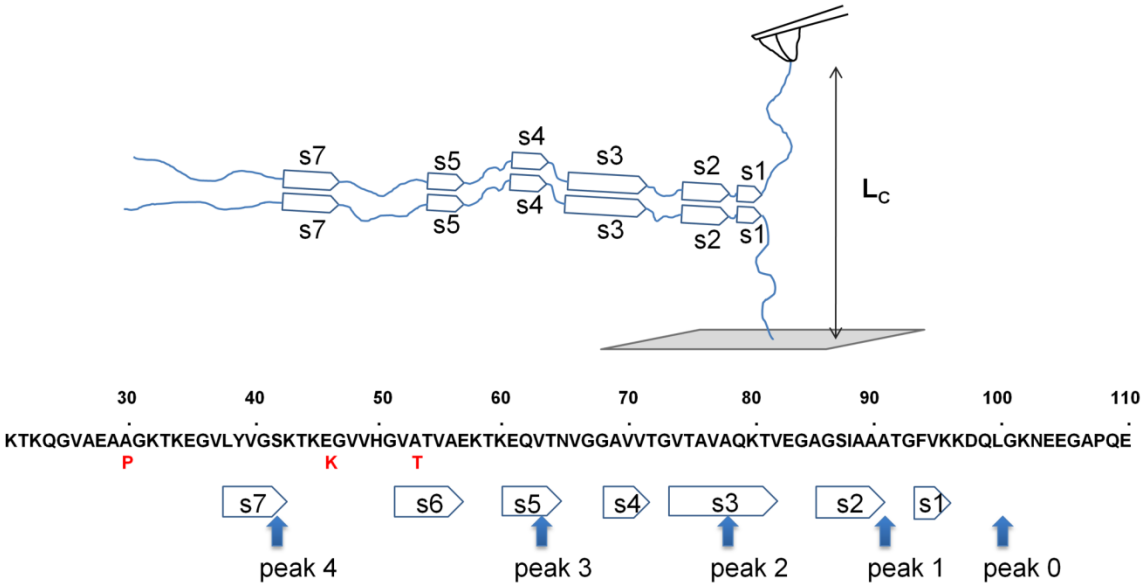


Figure S3. Rupture contour length histograms (A,B,C) and rupture force histograms (D,E,F) for the E46K mutant of α-Syn. A and D) single rupture event group (with contour length maxima at 17±3, 31±4 and 40±2 nm and a maximal rupture force of 29±5 pN), B and E) last events from multiple rupture group (with a contour length maximum at 41±3 nm and rupture force maxima of 27±7 and 50±11 pN), C and F) internal ruptures from multiple rupture group (with contour length maxima at 19±3, 26±3, 34±4 and 40±2 nm and a maximal rupture force of 49±14 pN).



Wild type alpha synuclein							
Interacting segments	s1-s1	s2-s2	s3-s3	s4-s4	s5-s5	s6-s6	s7-s7
Expected Lc, nm	32	35	42	48	53	59	69
Observed Lc, nm (WT)	28	34	44 (wide peak)		54	-	68
Peak number	0	1	2		3	-	4

Figure S4. Comparison of force spectroscopy data with ssNMR data. A) scheme showing interaction model with possible multiple interacting segments. B) Sequence of alpha-synuclein residues 21 to 110 showing: 1) positions of single point mutations (in red); 2) positions of beta strands in fibrils of alpha-synuclein proposed in (Heise et.al., JMB, **2008**, *380*, 444–450); 3) positions of the interacting segments determined in this study. C) table comparing expected contour length values based on the structure (ssNMR) proposed in (Heise et.al., JMB, **2008**, *380*, 444–450) and observed contour length values determined with force spectroscopy.

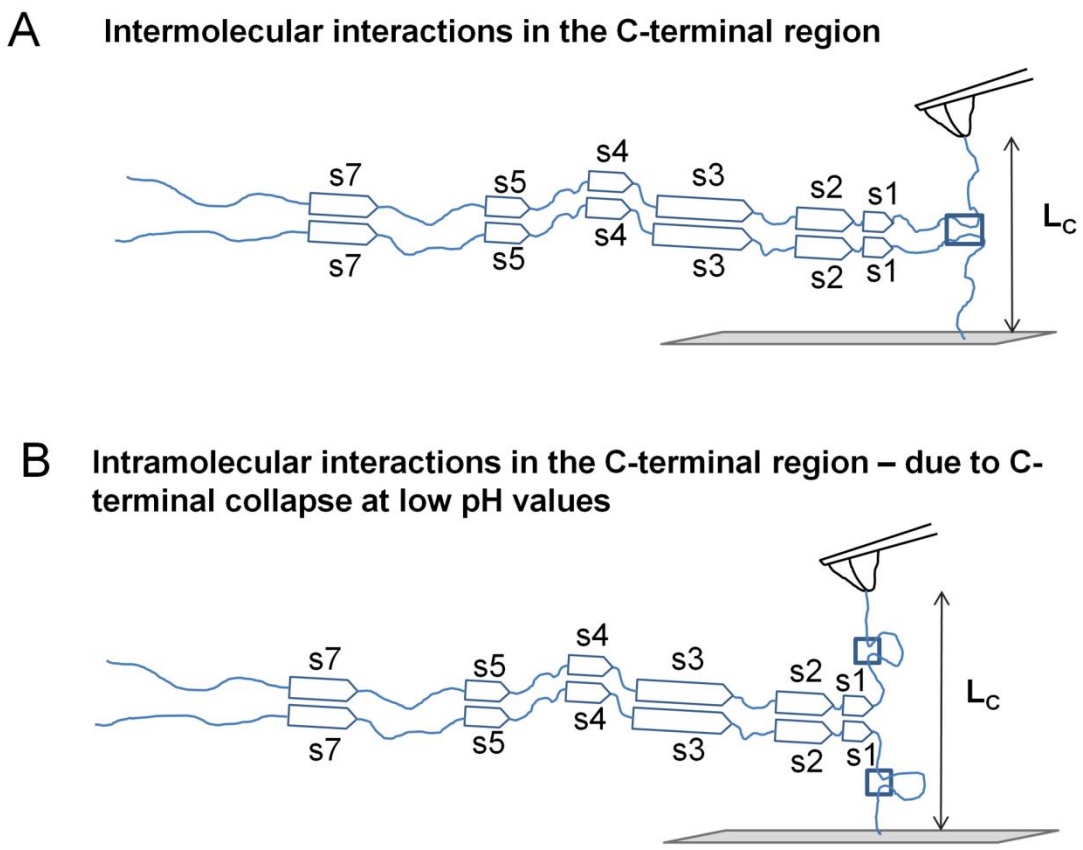


Figure S5. Two possible scenarios for observation of short contour length values: A) intermolecular interactions between segments in the C-terminal region and B) intramolecular contacts that resist pulling.

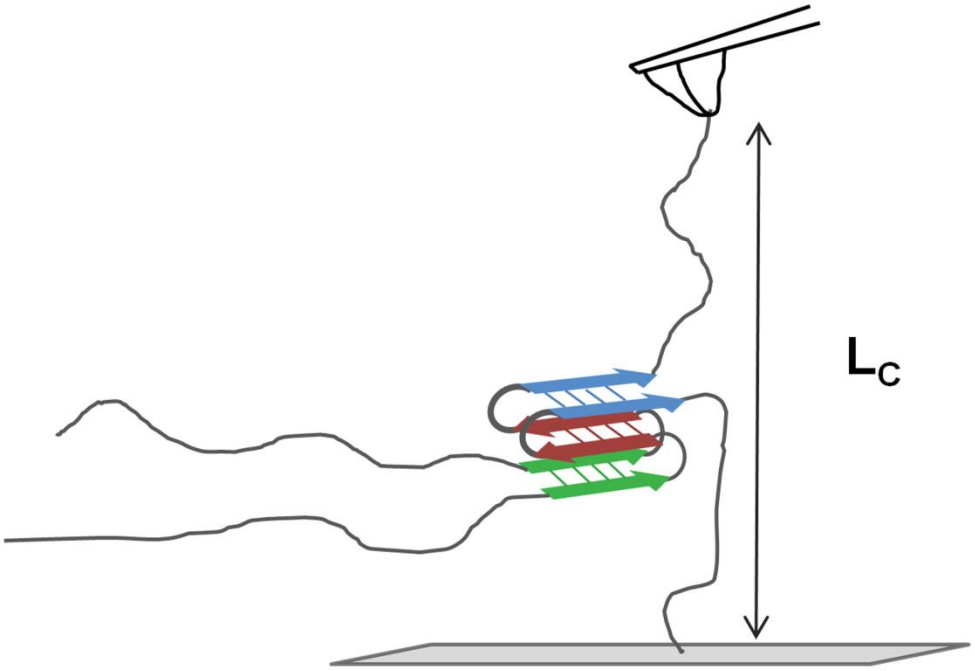


Figure S6. Rupture of folded monomers may produce complex force-distance curves with multiple ruptures.

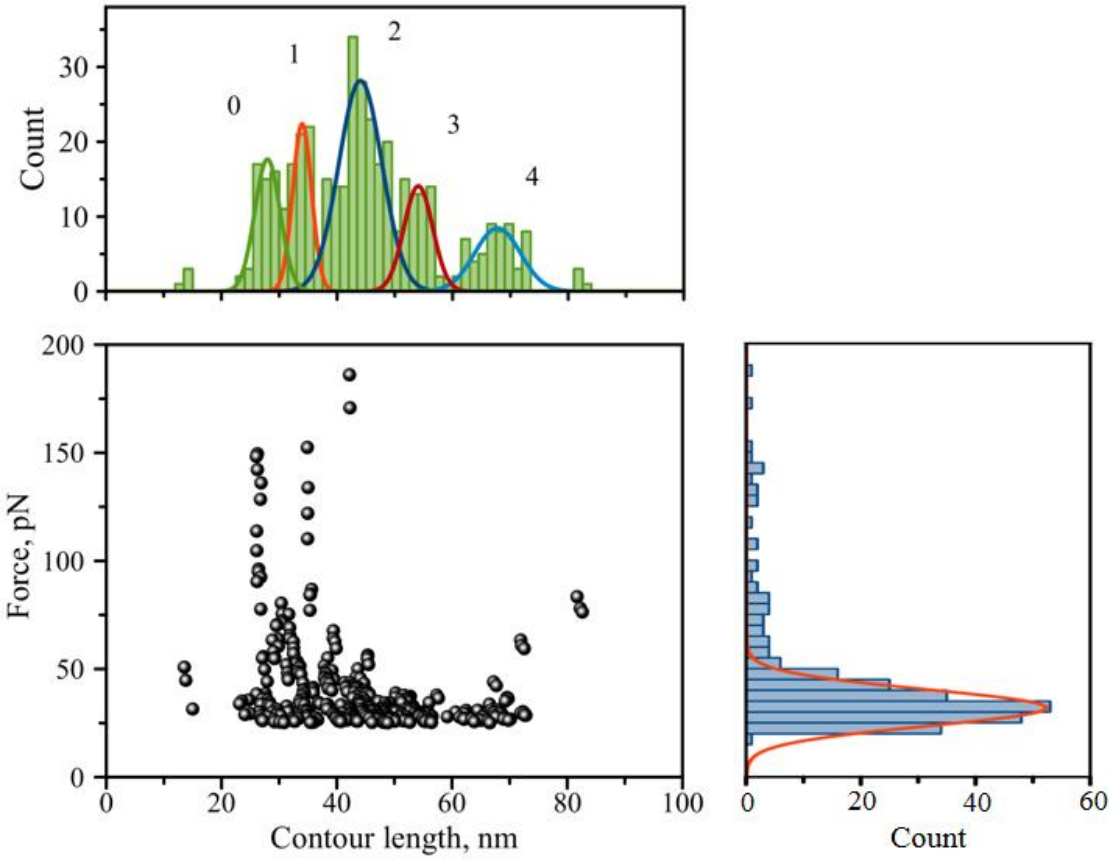


Figure S7. A combined 2D plot correlating the rupture force and the contour length for WT alpha-synuclein (SR group of force-distance curves). The plot is supplemented with the force distribution (to the right) with y axis same as for scatter plot - Force, pN and the contour length distribution profile (above) with x axis same as for scatter plot – Contour length, nm.

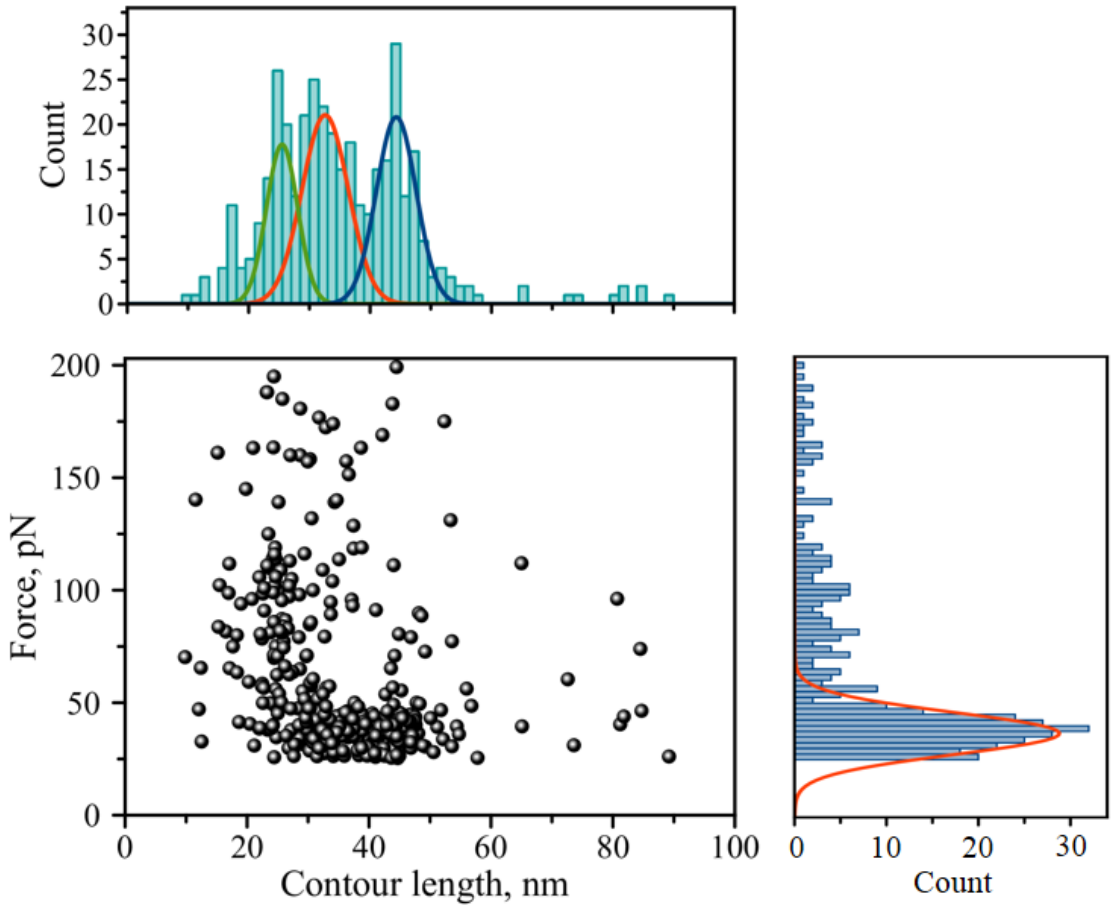


Figure S8. A combined 2D plot correlating the rupture force and the contour length for A53T alpha-synuclein (SR group of force-distance curves). The plot is supplemented with the force distribution (to the right) with y axis same as for scatter plot - Force, pN and the contour length distribution profile (above) with x axis same as for scatter plot – Contour length, nm.

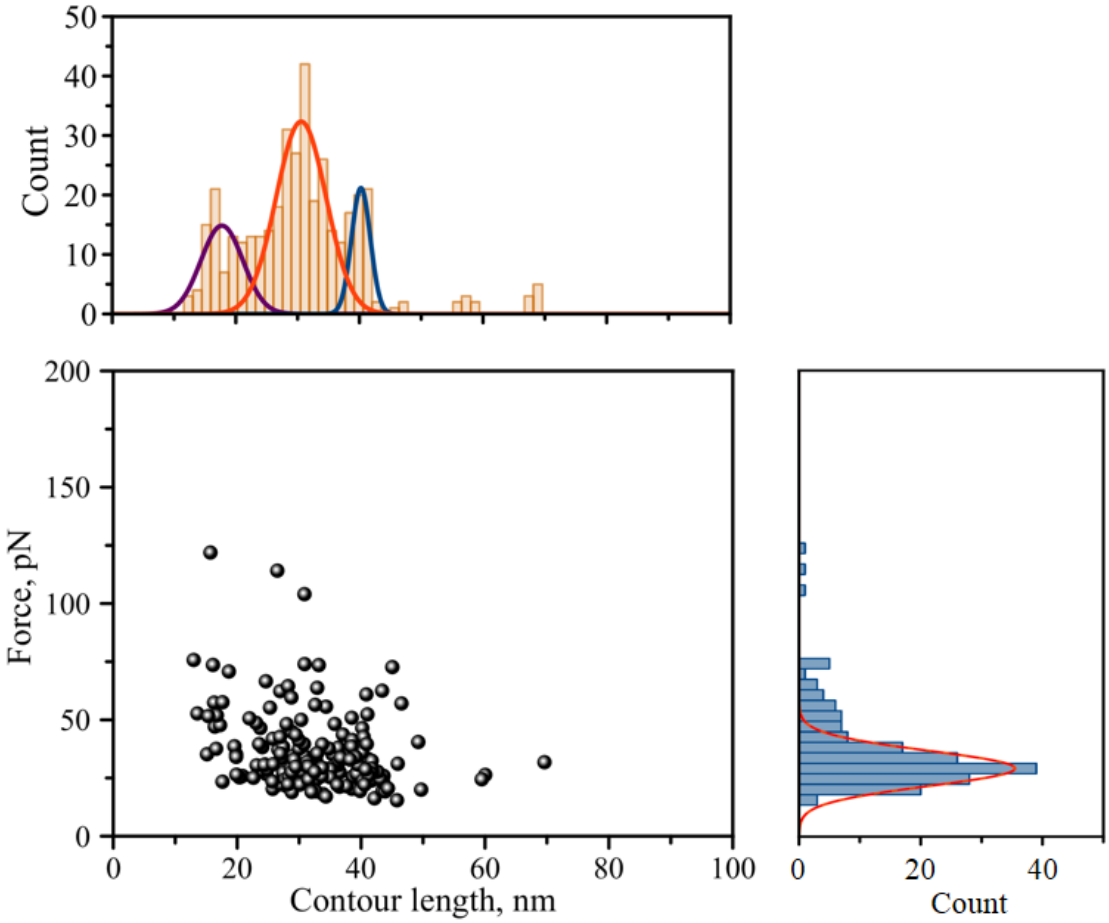


Figure S9. A combined 2D plot correlating the rupture force and the contour length for E46K alpha-synuclein (SR group of force-distance curves). The plot is supplemented with the force distribution (to the right) with y axis same as for scatter plot - Force, pN and the contour length distribution profile (above) with x axis same as for scatter plot – Contour length, nm.

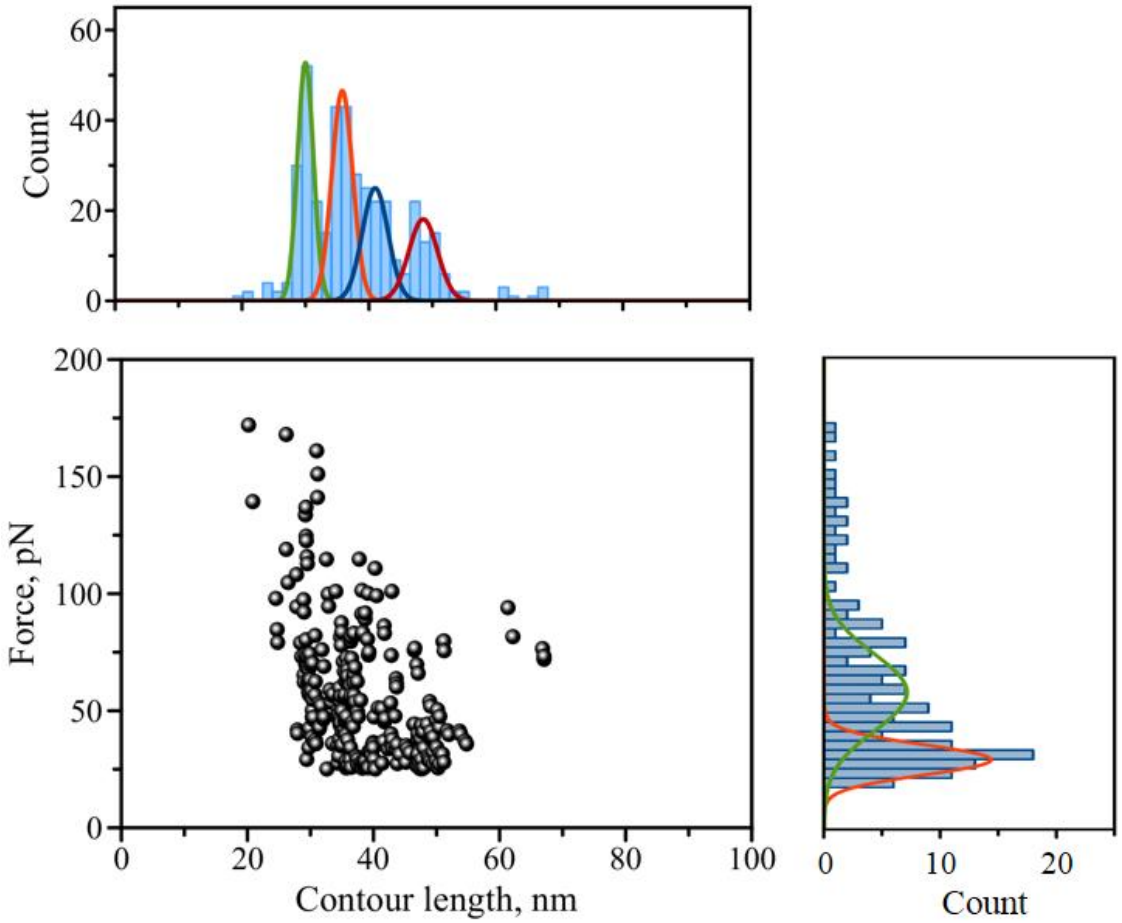


Figure S10. A combined 2D plot correlating the rupture force and the contour length for A30P alpha-synuclein (SR group of force-distance curves). The plot is supplemented with the force distribution (to the right) with y axis same as for scatter plot - Force, pN and the contour length distribution profile (above) with x axis same as for scatter plot – Contour length, nm.