Steered MD (and AFM) study of neuronal protein neurexin

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Neurexins (NRXNs) are large family of synaptic cell-adhesion molecules that connect presynaptic and postsynaptic neurons at synapses. They may form complexes with presynaptic protein neuroligin, mediate signalling across the synapse and shape the properties of neural networks [1]. There is increasing evidence that NRXNs are associated with schizophrenia and autism spectrum disorders [2].

We apply, for the first time, steered molecular dynamics (SMD) simulations using NAMD program (version 2.8) and CHARMM force field, in order to better understand nanomechanics of NRXNs. Fourteen SMD explicit solvent simulations (total length about 0.5 μs) with three different direction of pulling of NRXN1α (1296 amino acids, over 64 000 atoms) have been preformed. In our SMD study we want to recognize the mechanical properties of NRXN1α and characteristic hinge occurrence presented in our Atomic Force Microscopy (AFM) experiment [3].

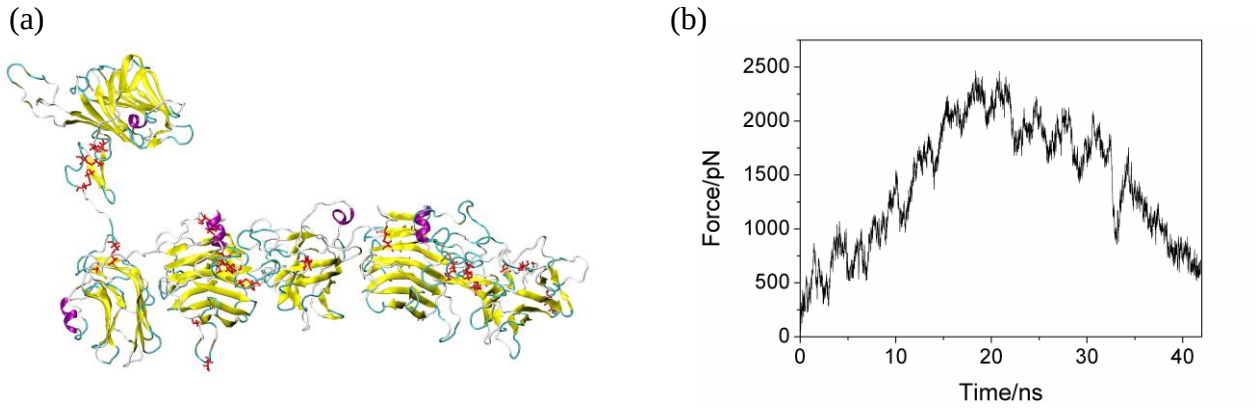

Fig. 1. (a) 3D structure of NRXN1α (1296 aa), (b) Force vs. time curve from SMD simulation.

We combine different types of research methods (theoretical SMD and experimental AFM) to discern the mechanical stability and the characteristic behaviour of NRXN in synaptic junctions.

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