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Direct Measurement of Inter-filament Forces in Neurofilament Networks: Synchrotron X-ray Diffraction Study under Osmotic Pressure

R. BECK, J. DEEK, C.R. SAFINYA, UC Santa-Barbara — Neurofilaments (NFs) are the major protein constituents in neuronal processes (axons and dendrites) that impart mechanical stability and act as structural scaffolds. The filaments assemble from 3 different subunit proteins (NF-L, NF-M, NF-H) to form a 10 nm diameter flexible polymer with radiating unstructured sidearms. Recent work, showed that at high protein concentration, the NFs form a nematic hydrogel network with a well-defined interfilament spacing as can be measured by synchrotron small angle x-ray scattering (SAXS) [1]. In order to directly elucidate the interfilament forces responsible for the mechanical properties of NFs hydrogel, we conducted a SAXS-osmotic pressure study, which yielded pressure-distance curves at different subunit compositions and monovalent salts. We show that filaments composed with NF-L and NF-M strongly attract each other through their polyampholyte sidearms, in particular at high monovalent salt. However, filaments comprised of NF-L and NF-H, show a distinctly different pressure-distance dependency, with much larger interfilament spacing and weaker salt dependence. Supported by DOE DE-FG-02-06ER46314, NIH GM-59288, NSF DMR-0803103, and the Human Frontier Science Program organization. [1] J.B. Jones, C.R. Safinya, *Biophys. J.* **95**, 823 (2008)

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