al. 2004) or enhance the brightness of an environmentally sensitive fluorophore by hosting it in the hydrophobic pockets formed as a result of the self-assembly (Cai et al. 2014; Gao et al. 2012).

High-throughput screening

Hydrogels offer unique wet environment that retains protein activity. Thus, molecular probes that have prolonged preserved recognition properties can be developed based on supramolecular gels. Arrays that allow high-throughput screening are one example of such application (Yamaguchi et al. 2005; Kiyonaka et al. 2004; Yoshimura et al. 2004). The semi-wet arrays overcome the main drawback of classical screening platforms in which the bioactivity of the protein is compromized as a result of its immobilisation to the solid support. Indeed, enzymes (Kiyonaka et al. 2004) and artificial receptors (Yoshimura et al. 2004) can be entrapped in supramolecular hydrogel matrices where many nanofibers are entangled to form aqueous microcavities, which can host the biomolecules and, the hydrophobic domains of the fibers are used as a site for monitoring the reaction (by enhancing the fluorescence as previously described). Besides the advantages mentioned above, the signal/noise ratio in such systems is improved because the microcavities are accumulated in a 3D manner and changes can be observed both by naked eye or simple digital camera (Yoshimura et al. 2004).

Biocatalytic Self-Assembling Systems as Cancer Therapeutic Tools

In 2007, Xu and co-workers demonstrated that the PA naphthalene-diphenylalanine-$NHCH_2CH_2OH$, modified to include a butyric diacid motif (cleavable by esterase), self-assemble upon biocatalytic conversion and regulate the death of HeLa cells (Yang et al. 2007b) without affecting NIH3T3 fibroblasts that presented a lower esterase activity. These results demonstrated the very promising impact of BSA for selective cancer treatment. Indeed, the concept was expanded to include other enzymes that are overexpressed in cancers and also initiate the downstream apoptosis pathway using PAs specifically designed to be sensitive to those enzymes (Zorn et al. 2011; Tanaka et al. 2015). While the trigger of apoptosis by PAs may be different for different cancer types, the mechanism of action was found to be the same in each case and related to the intracellular presence of nanofibers but not with the un-assembled PA itself (Julien et al. 2014). Indeed, internalization of self-assembled nanofibers was shown to disrupt the self-assembly of crucial cell components, e.g., microtubules, leading to cellular death (Kuang and Xu 2013) (Fig. 3).

The pericellular space is also rich in bio-entities and there are different ecto-enzymes that have been identified as cancer markers. Indeed, these can be also used under BSA (Kuang et al. 2014; Pires et al. 2015). The mechanism in this case is different as the sol-gel transformation takes place in the pericellular space. The formed self-assembled nanofibers generate a network of fibers that block cell-matrix interactions (including metabolite exchange), leading to apoptosis and cell death (Fig. 4).