



INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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Thesis Title: Modulation of Amyloid Aggregation and Cancer Theranostic Using Luminescent Conjugate Materials

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SHORT ABSTRACT

Protein aggregates are associated with neurodegenerative diseases, and they are increasingly recognized as important in cancer and diabetes. This thesis focuses on small molecule and polymer based luminescent materials on amyloid aggregation in order to modulate amyloid aggregates with an additional feature of self-indication. Mutual aggregation between amyloid and modulator becomes predominant compared to self-aggregation due to oligo-blocking and/or formation of co-aggregates. A versatile polyfluorene derivative, PF-HQ showed an amyloid-like surface motif and hence, due to this similar interacting interface, it showed an excellent in vitro inhibition of amyloid aggregation by forming polymer-protein co-aggregates. Besides, this polymeric nanoparticle showed excellent dual emission in aqueous and as well as organic solvent and thus utilized in multi-color bio-imaging and drug delivery for cancer treatment. Unfortunately, these polymer nanoparticles were not able to cross blood brain barrier (BBB) due to its hydrophobic nature. To overcome this, a polymeric conjugate using polyfluorene (PF-DPA) and chitosan was developed. It can cross BBB and traps oligomers in A β and CSF. The similar interacting interface provided the adsorption and further inhibition to fibril formation. To achieve better optical correlation on protein aggregation, perylenebisimide isomers (PAPAP and APPPA) were designed with a hydrophobic dipeptide tail. As expected they showed a distinct aggregation pattern in presence of oligomers of A β and insulin amyloid. Interestingly, less aggregation prone derivative (APPPA) was able to cross BBB more proficiently and found efficient in modulating oligomers in A β and CSF whereas the other sibling, PAPAP was consistent with blocking insulin amyloid fibrillation. These findings may not directly involve in present clinical trials but definitely, provide guidance taking molecules and their promising aspects to clinical trials in order to achieve early diagnosis and prevention of neurodegeneration.