SUMMARY

Neurodegenerative disorders (NDs), which was believed to be associated only with the elderly, is now increasingly becoming prevalent in young people. Brain-derived neurotrophic factor (BDNF), a neurotrophic factor protein whose serum concentration, has a correlation with the neurodegenerative disordered state of an individual was seen to have a significantly lower serum concentration in diseased patients than in normal healthy patients. Hence, there is a need to clinically detect and quantify BDNF concentration in serum in order to help curb the prevalence and early onset of growing neurologic disorders especially in the young people. Currently, ELISA, Liquid Chromatography-Mass Spectrometry among others are methods used for BDNF detection and quantification with outstanding precision. These methods however require quite a lot of strict standard operating procedures, are relatively expensive and in some cases, require specialized operation of their systems which makes them not so feasible for rapid, on-the-spot, analysis. Therefore, sensors modified with synthetic receptors as recognition elements which are cheap, easy to prepare and stable, as compared to the biological receptors can be a prospective alternative analytical tool for BDNF rapid detection.

These synthetic receptors developed by virtue of molecular imprinting technology and known to possess inexpensive fabrication, excellent recognition for the target molecules for which they were made, good stability in both high and low pH and temperature conditions are called Molecularly imprinted polymers (MIPs). MIP films have shown successful application in biosensing, drug delivery, environmental analysis, therapeutic monitoring.

The goal of this thesis work was to prepare a BDNF-MIP film interfaced with a TFE as an inexpensive and miniaturized electrochemical sensor platform and to study the resulting BDNF-MIP/TFE sensor in terms of its sensitivity to and selectivity for BDNF.

Electrochemical surface imprinting approach was adapted for direct synthesis of BDNF-MIP on TFE sensor surface (BDNF-MIP/TFE). Polymer electrosynthesis was done potentiostatically at a potential of 600 mV (vs Ag/AgCl) and charge density of 2 mC/m^2. Afterwards, BDNF was successfully removed from the polymer matrix after washing the polymer in both mercaptoethanolic and acidic solutions for a total of 18 hours. The resulting BDNF-MIP showed quite high adsorption capacity towards BDNF, estimated by the imprinting factor (IF) of 5.12 and it also demonstrated high selectivity for BDNF when compared with other closely related neurotrophic factors and serum protein molecules. Notwithstanding, BDNF-MIP/TFE sensor was also able to detect BDNF in the presence of an

interfering protein, HSA, with a LoD value of 5.2 pg/mL (whereas for ELISA kits designed for BDNF, their LoD is approximately 12.2 pg/mL).

To summarize, a BDNF-MIP/TFE sensor capable of selective detection of BDNF protein in artificial serum was successfully fabricated using an electrochemical surface imprinting synthesis strategy. It is of vital importance to note that this possibility to integrate BDNF-MIP with thin film electrode sensors demonstrates great potential for prospective development of novel portable and robust point of care (PoC) devices for analytical sensing and real time diagnosis/prognosis of NDs in patients using their sera.