SUMMARY

In clinical practice, neurodegenerative diseases are becoming more common. The clinical diagnosis of these diseases only after the symptoms appear, delaying the treatment process and its success. Detection of biomarkers involved in neurodegeneration processes, has the potential to allow early diagnosis of neurodegenerative diseases. To assess the concentration of neurotrophins in serum, conventional methods like western blotting and ELISA are still utilized. Highly qualified analysts and specific work settings are needed for these time-consuming, expensive analytical approaches. Therefore, it is urgently demanded developing a quick, simple, and inexpensive technique allowing the detection of NF proteins. Molecularly imprinted polymers (MIPs), known for their molecular recognition ability, but synthetic nature providing exceptional chemical and thermal stability along with their repeatable and affordable manufacture, seems to be a great alternative to conventional methods.

In this thesis, an array of 96 screen-printed electrodes (96xSPE) was modified with a synthetic receptor, brain derived neurotrophic factor (BDNF)- selective molecularly imprinted polymer (BDNF-MIP), to create an electrochemical sensor (BDNF-MIP/96xSPE) for the quick detection of BDNF in human plasma samples.

The BDNF-MIP was prepared as a thin film by a previously developed surface imprinting approach that involved at first forming a cleavable linking layer of 4-aminothiophenol (4-ATP) and 3,3’-dithiobis(sulfosuccinimidyl propionate) (DTSSP) monolayer on a working electrode of SPE, followed by BDNF covalent immobilisation to the DTSSP linker, electropolymerization of m-PD and finally the removal of BDNF via linker cleavage (mercaptoethanol) and subsequent treatment in acetic acidic solution. Characterization of BDNF-MIP modification was carried out using CV and EIS. Electrochemical detection of BDNF was performed measuring DPV voltammograms in the redox probe after incubation of BDNF-MIP-modified 96xSPE (BDNF-MIP/96xSPE) in the plasma containing BDNF.

It was discovered that the most sensitive operating conditions for BDNF-MIP/96xSPE required a 1000-fold dilution of human plasma. The BDNF-MIP/96xSPE showed linearity of their responses in the range of 1 - 1000 ng/mL, spanning across the normal level of BDNF in blood samples. The evaluation of blind samples showed a strong correlation between the BDNF-MIP/96xSPE-determined concentrations and spiked values, with the percentage deviations falling between about 2-27%. It is worth noting the high throughput screening capability of the BDNF-MIP/96xSPE allowing for separate electrochemical detection of BDNF

from up to 96 probes. Thus, multiplexing capacity of electrochemical detection of BDNF from human plasma samples is provided.

The author believes that the result from this research will contribute to further scientific development of the detection of BDNF in human plasma. Future research would concentrate on testing the sensor in real samples and demonstrating capacity for point-of-care testing (PoCT) to further establish its potential usefulness for the intended practical application.