Alzheimer’s disease (AD) is a severe neurodegenerative disease with a characteristic progressive decline in cognitive functions and dementia. It is believed that the majority of all AD patients are affected by the sporadic form, caused by the combined effects of several risk factors. Currently there exists no simple test or biological markers that could detect AD cases, and the definite diagnosis of AD is based on histopathological evidence obtained from autopsy.

This thesis deals with the problem of finding reliable biochemical markers in the peripheral venous blood. Increasing evidence suggests that abnormal processing of amyloid precursor protein and oxidative stress may play an important role in the pathogenesis of AD. The present study characterizes the usefulness of systemic oxidative stress, platelet amyloid precursor protein ratio, plasma and red blood cells beta amyloid (Aβ 1-42) levels in the diagnosis of AD and to monitor the progression of the disease. The biochemical markers were quantified in the lymphocytes, red blood cells, platelets and plasma of probable/possible sporadic AD patients and non demented age matched healthy controls.

There was a significant increase in reactive oxygen species (ROS) production in lymphocytes, coupled with increase in erythrocyte antioxidant enzymatic activities of superoxide dismutase and glutathione peroxidise in AD. In parallel to increase in ROS, measurement of 8-0HdG as an index of DNA damage revealed a significantly higher level in AD. The present study also found that the plasma glutathione redox system is also affected as reduced glutathione (GSH) were significantly lower in AD; conversely oxidised glutathione (GSSG) levels were significantly elevated and the GSH/GSSG molar ratio was found to be low in AD.
The present study also found a reduction in platelet APP ratio. The magnitude of the APP ratio reduction is proportional to the severity of the cognitive loss in AD. This indicates that platelet APP is processed by the same amyloidogenic and non amyloidogeneic pathways as utilised in the brain. The mean plasma Aβ1–42 levels were higher in AD compared to age matched healthy subjects. In erythrocytes the mean RBC Aβ1–42 levels were found to be decreased in AD but there was substantial individual variability and overlap in plasma and RBC Aβ1–42 levels between these groups because of this plasma and RBC Aβ1–42 levels did not statistically differ from AD and controls.

Taken together, altered oxidant and antioxidant levels in red blood cells, lymphocytes and plasma the present study states that these biochemical markers may be useful in selecting AD patients for treatment trials, and in screening the efficacy of treatments of AD. Since platelet APP ratio is decreased at different stages of AD and abnormal APP processing is related to the neuropathological changes in AD brain, the present study suggests that the APPr may assist in the early diagnosis of AD in individuals at risk for the disease and would be able to improve the diagnosis and monitor the progression of the disease.