Chapter 1: Introduction

1.1 Background

Alzheimer's disease (AD) is a neurodegenerative disease characterized by the presence of amyloid β (Aβ) plaques and neurofibrillary tangles in the brain (Serrano-pozo, Frosch, Masliah, & Hyman, 2011). People suffering from AD experience a gradual decline in memory and cognitive function (Alzheimer Association, 2015; Apostolova, 2016) and they require help in daily activity since they experience difficulty in long-term memory, working memory, problem-solving, comprehension, reasoning, and language disturbance (Apostolova, 2016). AD progresses slowly, becoming more severe and eventually incapacitating the patient.

The main age category that is affected by AD is elderly, which are people older than 60 years old. Moreover, the chance of suffering AD increases exponentially after 65 years old (Sheng, Sabatini, & Sudhof, 2012). In 2017, the United Nation reported that more than 900 million of the world population is above 60 years old and in 2050, the number is expected to double to 2.1 billion (United Nation, 2017). The situation makes AD a significant threat to the global population, as numerous people are at risk of suffering AD.

Currently, treatments for AD include cholinesterase inhibitors (CI), N-methyl-D-aspartate (NMDA) antagonists, combination therapy, and neuropsychiatric drugs. However, these treatments only manage to ameliorate the symptoms without curing the disease (Yiannopoulou & Papageorgiou, 2013). Effective treatments for AD are now under extensive research to help improve the quality of life of those affected.

A particular method that has the potential to become a novel treatment for AD is environmental enrichment (EE). EE makes use of an augmented environment with various sensorimotor, cognitive, and social stimulation. These types of stimulations could affect brain plasticity, restore brain functions, and facilitate new neural connections (Salmin et al., 2017). Therefore, previous studies have suggested that EE might be an effective treatment to combat AD.

Recent studies on the effect of EE on AD mouse models have shown that there are beneficial effects on Aβ deposits (Beauquis et al., 2013; Costa et al., 2007; Lazarov et al., 2005; Ziegler-waldkirch et al., 2018), neuroinflammation (Beauquis et al., 2013; Griñan-ferré et al., 2016; Xu et al., 2016), neurogenesis (Hu, Bergström, Brink, Rönnbäck, & Dahlqvist, 2010; Rodríguez et al., 2011; Salmin et al., 2017; Ziegler-waldkirch et al., 2018), and cognitive function (Berardi, Braschi, Capsoni, Cattaneo, & Maffei, 2007; Costa et al., 2007; Prado-Lima et al., 2018; S. A. Wolf et al., 2006; Yeung et al., 2015). However, all of these studies have utilized different types of EE models as a treatment. Hence, EE studies using a standardized method is necessary. Using a standardized cage such as the standardized MARLAU™ cage may open the opportunity to optimize the search for better treatments against AD.

1.2 Objectives

This study has two objectives. The first objective is to find the effect of standardized EE treatment on cognitive function and immune response of AD mouse model. The second objective is to elucidate the possible mechanism of EE treatment on AD mouse model. This research may allow humanity to be one step closer to finding an effective strategy for combating AD.