Faculty of Health Sciences

2020 Australian Government Research Training Program Scholarships

Strategic Project Profile

PROJECT TITLE: Medicinal cannabis for a treatment of dementia by using novel nanoparticle nasal drug delivery system

FIELD OF RESEARCH CODE: TBA

PROJECT SYNOPSIS: Non-insulin dependent type-2 diabetes mellitus (T2DM) is well-recognized to induce cognitive impairment and significantly increase the risk of dementia by ~5-fold. However, the underlying mechanisms by which T2DM induces cognitive decline are not fully understood, and thus, there are no effective therapeutic strategies available for its prevention and treatment.

An emerging body of evidence is consistent with the hypothesis that chronically exaggerated neuroinflammation, oxidative stress, and insulin resistance of central nervous system (CNS) are associated with the onset and progression of cognitive decline in T2DM. Indeed, some recent studies show beneficial effects of both anti-inflammatory drugs and insulin sensitizing agents in stabilizing the cognitive performance in dementia patients and in animal models of cognitive dysfunction. However, there are no reported studies that have successfully arrested cognitive decline in chronic/long-term T2DM. Restoration, or indeed maintenance of healthy cognitive function in T2DM would be an exceedingly innovative clinical finding with significant global impact.

The use of medicinal cannabis is rapidly gaining substantial interest for many neurological disorders including Autism and multiple sclerosis, primarily due to potent anti-inflammatory and anti-oxidative properties of cannabinoids such as cannabidiol (CBD). Additionally, CBD is known as a full agonist of peroxidase proliferator activator receptor-γ (PPARγ), providing additional insulin-sensitizing and neuroprotective effects. Furthermore, recent studies also demonstrate that CBD substantially improves neuroplasticity and promotes neurogenesis, indicating a remarkable potential for the treatment of T2DM-associated cognitive decline.

Like many other proposed pharmacological interventions, a major challenge for CBD indication is in its low CNS bioavailability. The supervisory team has developed a highly innovative dual-ligand nanoparticle drug delivery system that in preliminary studies suggests markedly increased brain delivery and retention of existing dementia medication, rivastigmine. By using this innovative brain-targeted drug delivery technology with CBD, the proposed project will be a world-first study to aim for the long-term prevention and restoration of cognitive function in an established, clinically relevant murine model of T2DM-associated cognitive decline.

WHAT MINIMAL ATTRIBUTES AND SKILLS EXPECTED BY THE CANDIDATE BE COMPETITIVE:
Preferably Honours I or equivalent. Not essential but ideal to have basic knowledge in Chemistry, Biochemistry, Physiology, and Pharmacology. Although not essential but desirable skills in basic laboratory techniques, research animal handling and data analyses.

Students are advised to contact the Project Lead listed below prior to submission of their scholarship application to discuss their suitability to be involved in this strategic project.

PROJECT LEAD CONTACT

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