Voltage-dependent potassium channels (Kv1.3) play key role in a wide variety of physiological processes, including immunity, metabolism and the stabilization of the resting potential. In brain, activation of insulin receptor is able to induce current suppression coupled to tyrosine phosphorylation of Kv1.3 channel. Moreover, insulin can reduce the production of free radicals and attenuate the inflammatory response. The Kv1.3 channel blockers, such as neurotoxins isolated from scorpion venom, are able to alter neuronal excitability leading to neurological disorders accompanied by inflammatory response.

The aim of this study is to evaluate the neuroprotective effect of insulin injected by intracerebro-ventricular (i.c.v.) route on neuro-inflammatory response and oxidative stress induced by kalotoxin (KTX) a blocker of Kv1.3 channel. The ability of insulin to reduce the brain injuries, inflammatory response and oxidative stress biomarkers induced by KTX were assessed in NMRI mice at 24 h after co-injection of insulin and neurotoxin active on potassium channel.

Obtained results revealed that the central administration of insulin prevents cerebral cortex injury, brain edema, cells infiltration and a change in the permeability of the blood-brain barrier induced by KTX. Insulin seems to also reduce significantly the pro-inflammatory cytokines (IL-6, IL-17, TNF-α), MMP-2 and MMP-9 activities and oxidative stress markers (H2O2, NO, MDA) in brain homogenates compared to those observed when animals were injected with KTX alone.

Conclusion:
These results indicate that insulin is able to modulate the activity of potassium channels in brain by modifying their properties, which probably prevent the binding of neurotoxin to its receptor Kv channel and thus reduce the neuro-pathophysiological effects. These data suggest that insulin is not only vital to the brain but it may also exert an influence modulating several brain functions in which Kv1.3 channel are involved. The use of Kv1.3 channel blockers such as KTX or insulin could be potential pharmacological tools that can elucidate or better understand neurological mechanisms in the pathogenesis related to the dysfunction of ion channels such as multiple sclerosis, epilepsy and Alzheimer’s diseases.