Attachment 7: Innovation Statement (one-page limit): Upload as “Innovation.pdf”.

Summarize how the proposed research is innovative. State how the research challenges

existing paradigms or provides new paradigms, technologies, evidence-based diagnoses,

and/or applications for ASD. Investigating the next logical step or an incremental

advancement on published data is not considered innovative.

To date, most management efforts for cognitive behavioral impairments of children affected by autism have mainly centered around psychoeducational methods and some degree pharmacotherapy. The success of these methods, however, has been very limited such that many of these children are unable to achieve even minimal levels of independence, imposing financial and emotional burdens on their relatives and caregivers.

Studies of the use of tDCS neurostimulation as a means of treating cognitive deficits, motor dysfunction, and aggression in individuals affected by neurodevelopmental disorders is highly innovative. We are the first to suggest using tDCS as a therapy that can directly affect major cognitive, behavioral, and motor deficits in model mice in a manner that can be tested and scrutinized for its efficiency. A particularly groundbreaking aspect of this proposed study is our focus on the molecular and metabolic mechanisms that underly the effects of tDCS effects on cognitive, behavioral, and motor deficits related to these neurodevelopmental disorders.

One key advantage of neurostimulation techniques such as tDCS is that they employ a wearable device and offer functional specificity. Both features are enormously advantageous when treating children with autism, as these children can wear these devices on their heads while they are practicing and being taught. Although some studies have suggested that, given the beneficial features and advantages of tDCS, it can be of use in neurodevelopmental disorders, we suggest a completely new approach wherein metabolic and molecular parameters are instead examined in detail. Efforts to understand the metabolic effects of tDCS offer several promising opportunities. First, this strategy will provide a readout assay for its efficiency that will enable further optimization thereof. For example, the efficiency of stimulation parameters is difficult to judge when using purely subjective behavioral outcomes, and a more objective endophenotype such as measuring a metabolite is much easier and straightforward. Measurements of such metabolites can eventually be extended to human studies using appropriate functional imaging techniques or simple dynamic blood tests to measure these metabolites. In addition, the novelty of studying the accompanying metabolic changes and the related molecular processes has the potential to suggest a pharmacological co-therapy strategies that will augment the efficacy of tDCS by manipulating the relevant molecular and metabolic pathways. Enabling the augmentation of neurostimulation using a directed pharmacological approach is also a truly innovative element of the proposed research.