Modeling Neural Disorder via Involuntary Response Simulator

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60,000 domestic cases of Parkinson's disease (PD) are diagnosed annually, while 7 million individuals have Essential Tremor (ET). My project provides simulation, diagnosis, and therapy to reduce symptoms of PD or ET via the Involuntary Response Stimulator, IRSt, a computer controlled padded arm cuff coupled to a pair of opposing solenoids driven by an opto-isolated programmable waveform generator. PD causes tremors, muscle stiffness, amnesia, and speech impairment, whereas, ET only causes tremors. This common trait leads to misdiagnosis. The IRSt can help differentiate these two diseases. A healthy person's handwriting can be made to simulate that of PD (4.5 Hz waveform) or that of ET (9 Hz). This will help medical practitioners learn to differentiate the two diseases through personal experience. PD is caused by the degeneration of dopamine neurons in the substantia nigra (basal ganglia area controls movements and inhibits shaking). Present treatments boost nigral neurons activity with L-dopa (increases dopamine available). Eventually, too many neurons die, furthermore, L-dopa causes sleeplessness, etc. IRSt physical therapy can increase muscle control by training substantia nigra neurons to produce dopamine. The patient is instructed to resist the IRSt gyrations during an exercise like writing. The waveform generator is programmed to "random," dopamine production is maximized when a predicted result has a reduced but non-0 error compared to actual. Lastly, stem cells introduced into the substantia nigra will differentiate into dopamine producing neurons. The IRSt helps prevent these cells from dying by stimulating integration into local neural wiring (resisting gyrations promotes synchronous firing).

Awards Won:

American Intellectual Property Law Association: First Award of $1,000