Using Hodgkin-huxley Differential Equations to Determine the Inhibitory Effects of Potent Neurotoxins that Lead to the Damaging of Voltage-gated Channels in Mammalian Neuron Cells Leading to Multiple Sclerosis

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Multiple sclerosis (MS), a disease that damages the neuroimmune system, is caused by the degeneration of myelin sheath, an insulating fiber located on a neuron's axon, which leads to the reduction of axonal action potential conduction; the reduction of axonal action potential conduction is caused by dysfunctional sodium and potassium channels where ions are blocked. Neurotoxins, chemicals that are destructive to tissues in the nervous system, inhibit the conductances of ions across the membranes of neurons, leading to the development of symptoms associated with MS. However, neurotoxins, such as tetrodotoxin and tetraethylammonium, are used for cancer pain therapies as they block channels to prohibit the transmission of pain signals. An experimentation was conducted that investigated the inhibitory effects of those two potent neurotoxins to inevitably determine the toxins' effects on voltage-gated channels using a set of calculus-based equations called the Hodgkin-Huxley differential model. The hypothesis was that of all possible neurotoxin concentrations, increasing concentrations of tetrodotoxin in a mammalian neuron would result in fewer displayed spikes with smaller amplitudes in one sinusoidal period on a voltage-clamp amplifier. The results of the experimentation showed that since there was a defined reduction in the neuronal membrane's current, the blockages that were developed in the channels due to the induction of the neurotoxins led to the development of symptoms associated with MS. The derived conclusion also showed that the usage of Pronase as a therapeutic option to treat multiple sclerosis is effective as the proteolytic enzymes served as antagonists to the neurotoxins' impacts.

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