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AN OPTIMAL STRATEGY FOR TREATING ALZHEIMER'S DISEASE

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Abstract: Alzheimer's disease is a progressive neurodegenerative dementia in which the brain accumulates amyloid plaques and generates neurofibrillary tangles. The disorder is common among the elderly; hence, it is associated with the process of aging. Dementias impair memory and cognitive skills. Imaging technologies of Positron Emission Tomography and Computed Tomography can reveal the existence of plaques and tangles, which have become hallmarks of the disease. Amyloid beta is cleaved from a precursor molecule in two stages. Normal amounts of protein amyloid beta have beneficial value. An excess is toxic to neurons. In healthy individuals, amyloid beta is cleared from the brain during sleep. With Alzheimer disease, clearance is inefficient resulting in clumping of amyloid beta fragments into plaques. Current and future drug treatments of Alzheimer are directed at curtailing production of amyloid beta, and relieving interference of signals between neurons. Two drugs that are currently in clinical trials are designed to block the activity of beta-secretase, an enzyme, to prevent cleavage. Another medication is aimed at mediating glutamate, a neurotransmitter, necessary for memory and learning that controls the introduction of calcium in nerve cells. From immunotherapy experience, a pill releases antibodies against amyloid beta to enhance clearance through the dura. Eli Lilly announced failure of solanezumab which prevents the formation of plaques. When compared with symptom-free volunteers who took a placebo and whose initial scans revealed high levels of amyloid beta, there was no improvement in the decline of cognitive abilities. The drug company concluded that amyloid beta may not be the cause of Alzheimer's disease, challenging the amyloid hypothesis. Microglia cells reside throughout the brain and spinal column. They scavenge the central system for plaques and dead neurons. Overexpression damages neurons, while their effectiveness diminishes with age. We shall discuss a therapy that utilizes an optimal protocol: that which minimizes deviations from homeostasis. The loss of microglia efficacy resulting from aging observed in a brain scan is compensated by an increase in dosage of the drug employed to remove amyloid beta. We let Δ represent the incremental rate of amyloid beta resulting from inefficient clearance, which is equal to aging rate a. Further, δ defines the optimal dosage used for protein removal. Then, $\Delta/c = a/c = \delta$, where c is a constant. Following this strategy, any benefit derived from normal levels of amyloid would be preserved, side effects avoided, and microglia would still be active removing plaques that remain.